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Routing and Handling Material
in Making a Quarter-Horsepower Motor

By L. C. Morrow
Managing Editor, *American Machinist*

Straight-line method of manufacture—Economy of floor space and man-power—How materials are handled—The advantageous use of belt conveyors

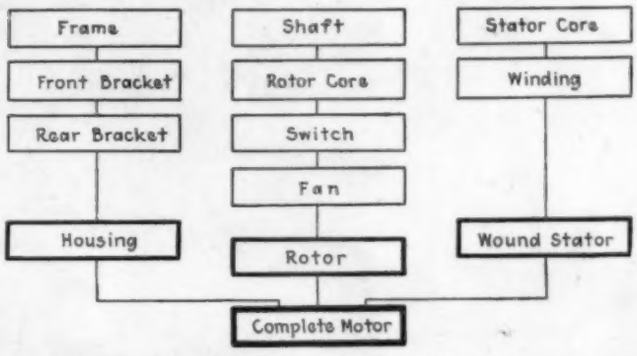
SMALL electric motors sell for small amounts of money and competition in their sale is keen. Manufacturing costs must perforce be low. Selection of machine tools and small tools for producing them can make or break the small motor business. So can the arrangement of the machines and the methods of handling the components. The combination of a judicious use of conveyors, proper containers and proximity of machines, along with modern machine equipment, makes the small motor business profitable even at present prices, when it is possible to manufacture the motors in comparatively large quantities.

The Westinghouse Electric & Manufacturing Co. specializes on the manufacture of small motors at its Springfield, Mass., plant and has developed a combination such as that just indicated. It is through the courtesy of the Westinghouse Co. that the illustrations and details presented here were obtained. They deal with the ¼-hp. motor.

The motor is constructed of few units, listed in the accompanying diagram.

With the exception of foundry, screw-machine and punching work, machine work, assembly, inspection and testing are done in two long bays. It happens that one bay is higher by one floor than the other, due to limitations of building length. The components are machined, and parts assembly is completed in an arrangement that brings the units together at one point for assembly into the completed motor. The floor plans of the machining and assembly departments are given in Figs. 1 and 2, and in following the operations as described in the text, this floor plan should be referred to constantly.

After being cast the base of the frame is trued on a Badger disk grinder and the periphery is smoothed on a polishing jack, using a canvas wheel. The frames are then taken into the shop on trucks, one of which is shown in Fig. 3, near the Natco multiple-spindle drill press on which the first machining operation is performed. Four holes are drilled in the base. The operator hardly has to move from his tracks to secure the frames from the truck and, when he has finished his operation, he places them in the box to his right, ready to be picked up for the second operation.



The operator to his right, running the Avey sensitive drill press with a Nelson Blanck Manufacturing Co. multiple head, with the same facility takes the frames from his left, drills four name-plate holes, and deposits the finished pieces in the tote box at his right.

As soon as a box has been filled with frames on which the second operation has been completed, it is moved a few feet to the Bullard mult-au-matic, where the frames are bored for the stator core and for front and rear brackets, reamed for the stator core and counterbored for the brackets. The last is an undercutting operation, performed on the bottom side of the frame as it is held in the chuck. Average production on the mult-au-matic is 500 frames per day of 8¾ hr. for one operator. The Bullard operator places his finished frames on the inspection bench at his left, where the inspector is shown at work in the illustration. These operations complete the frame.

Brackets for Housing

Front and rear brackets are snagged and tumbled in the foundry and are delivered in trucks, along the same aisle that the frames follow, past the frame-machining group to the two New Britain 4-spindle automatics and the Chas. G. Allen single-spindle sensitive drill press shown in Fig. 4. These three machines

First part of the article. The second part will appear in an early issue.

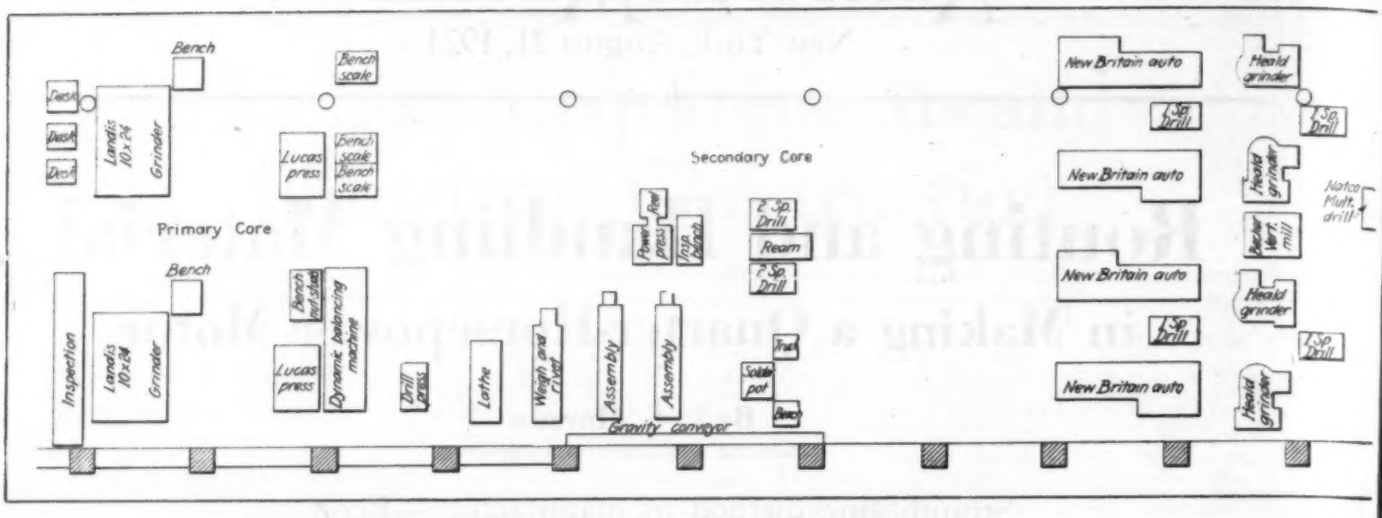
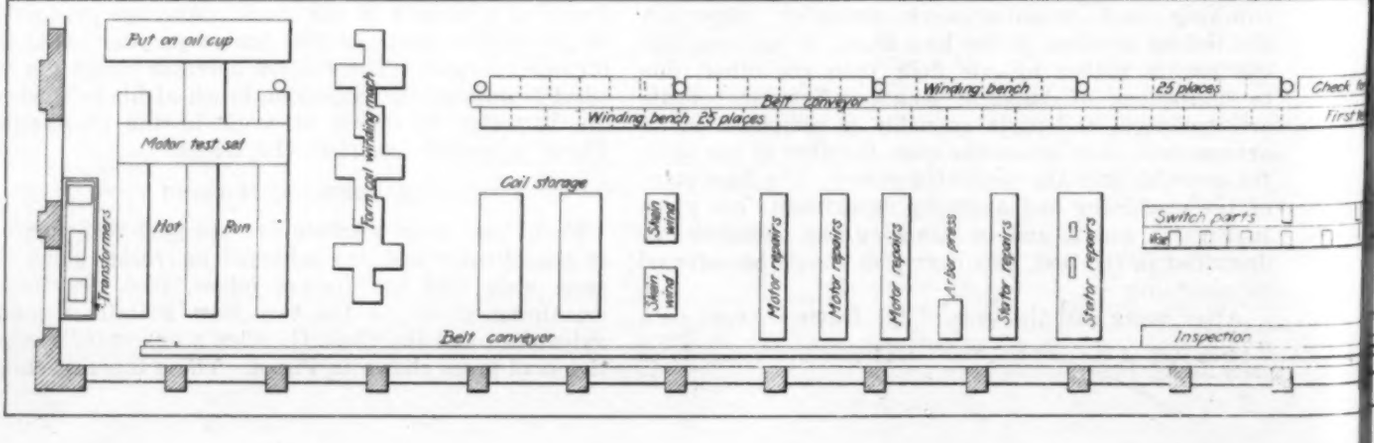


Fig. 1—Floor plan of machining department

Screw machine and press work are done in separate departments. Some machining operations are done in the department called the "assembly" department in this article. Why they are performed there will be apparent as the text is read.

Fig. 3—Machining frames

The frames are completely machined on the three machines shown in the foreground. The fourth operation, performed on the bench, is that of inspection and gaging.



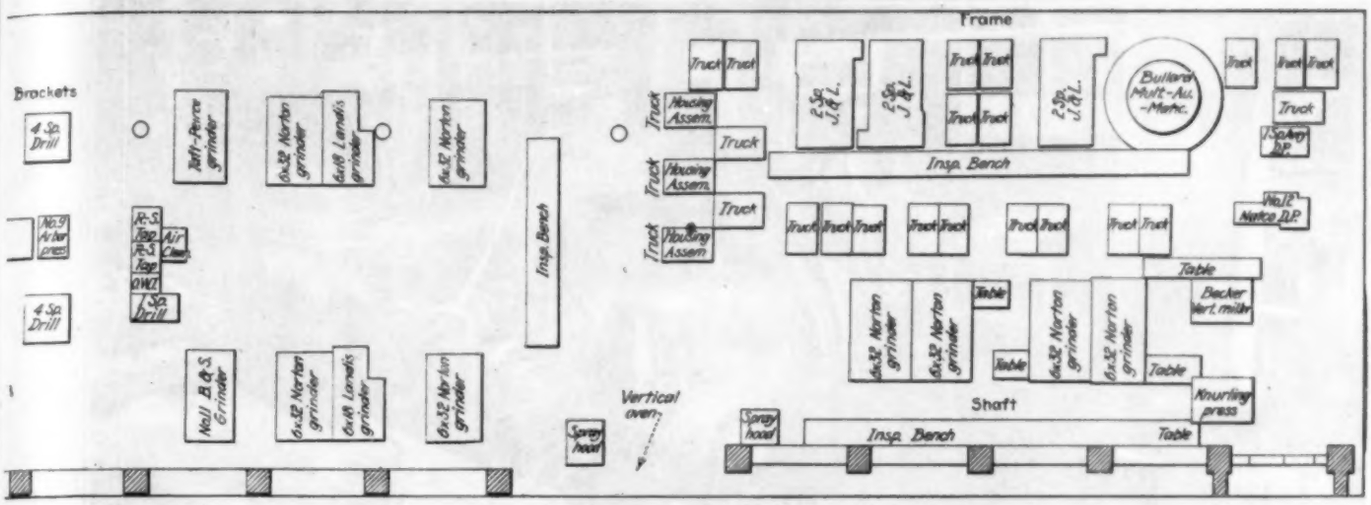


Fig. 4—First operations on brackets

Machining bearing bore. The two automatics and the drill press are operated by one man. The components are passed in racks to the operator in the background.

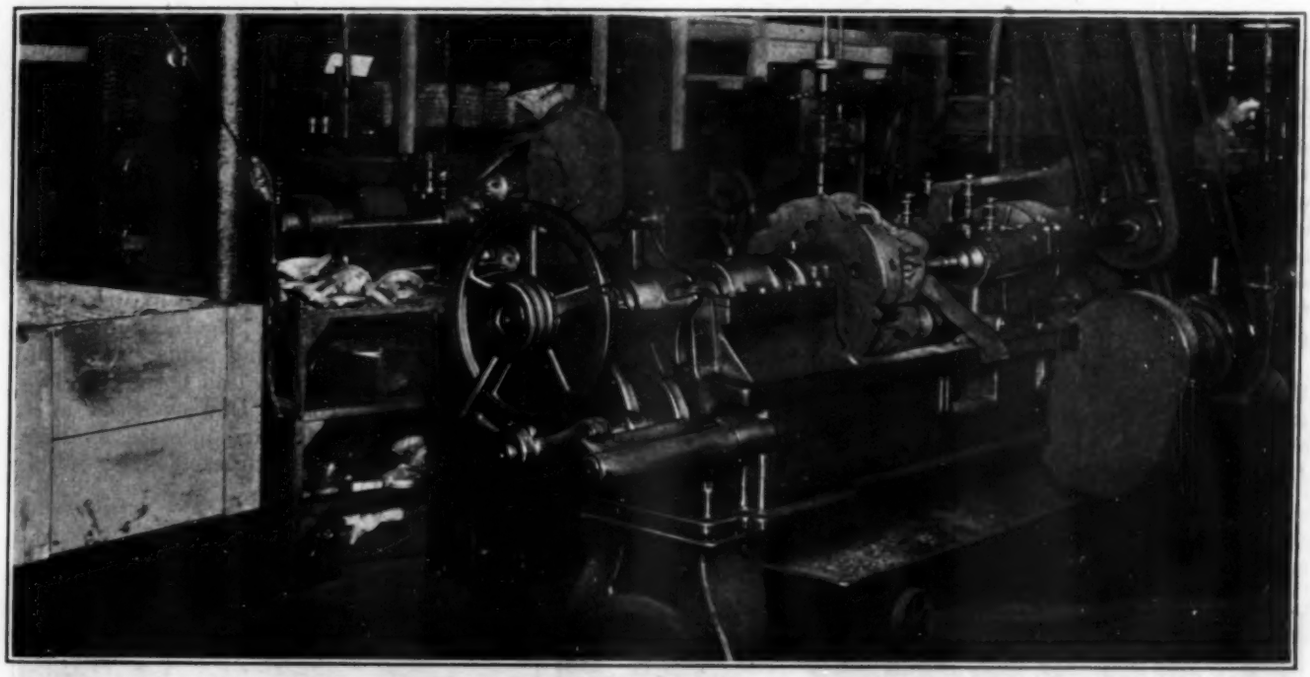
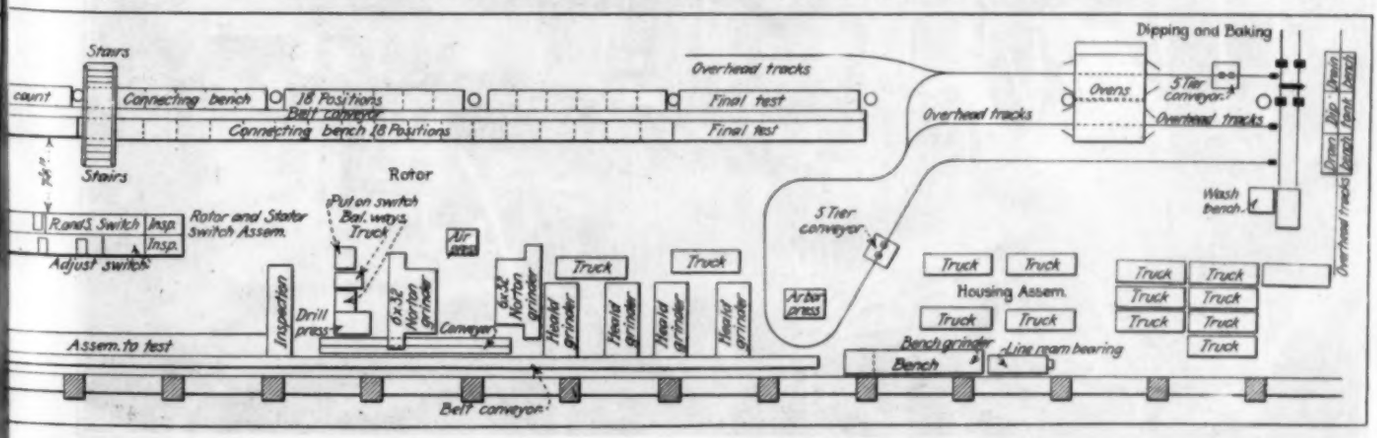


Fig. 2—Floor plan of assembly department

The fact that work travels back and forth in this department does not affect the correctness of the term "straight-line" routing. The processes turn a corner, to be sure, but a very important corner, since it is there that certain parts from the machining department are met and added to give the complete motor.



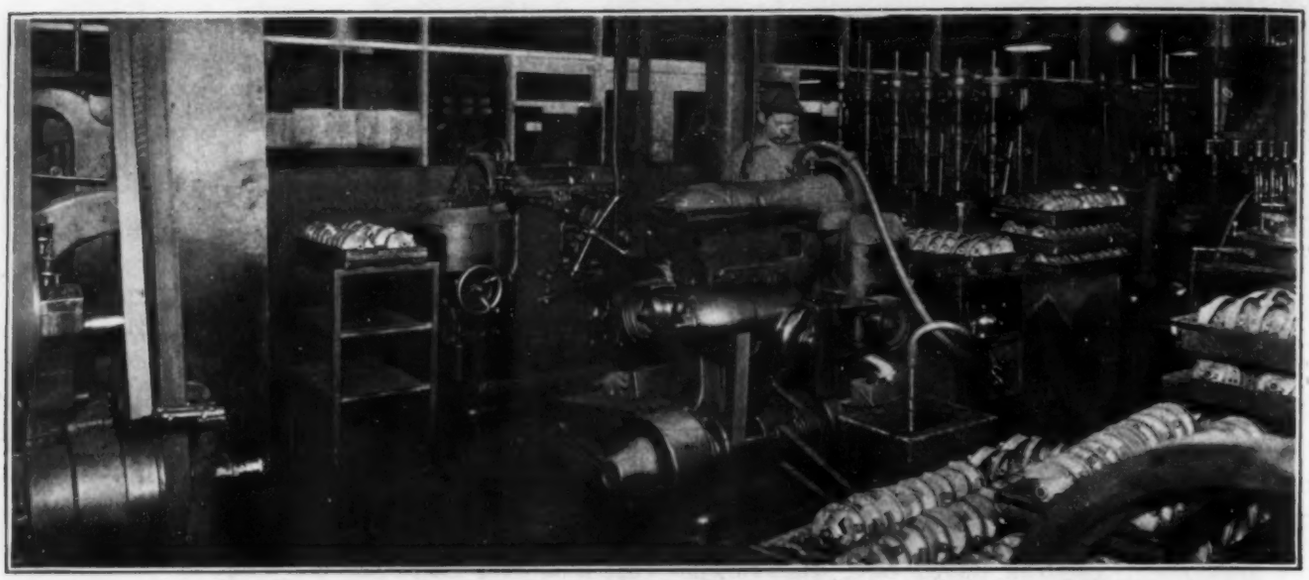


Fig. 5—Second operations on brackets

Grinding face on rotary surface grinders. One man operates two machines. There is no impression of crowding, yet no time is lost in transporting components from one operation to the other.

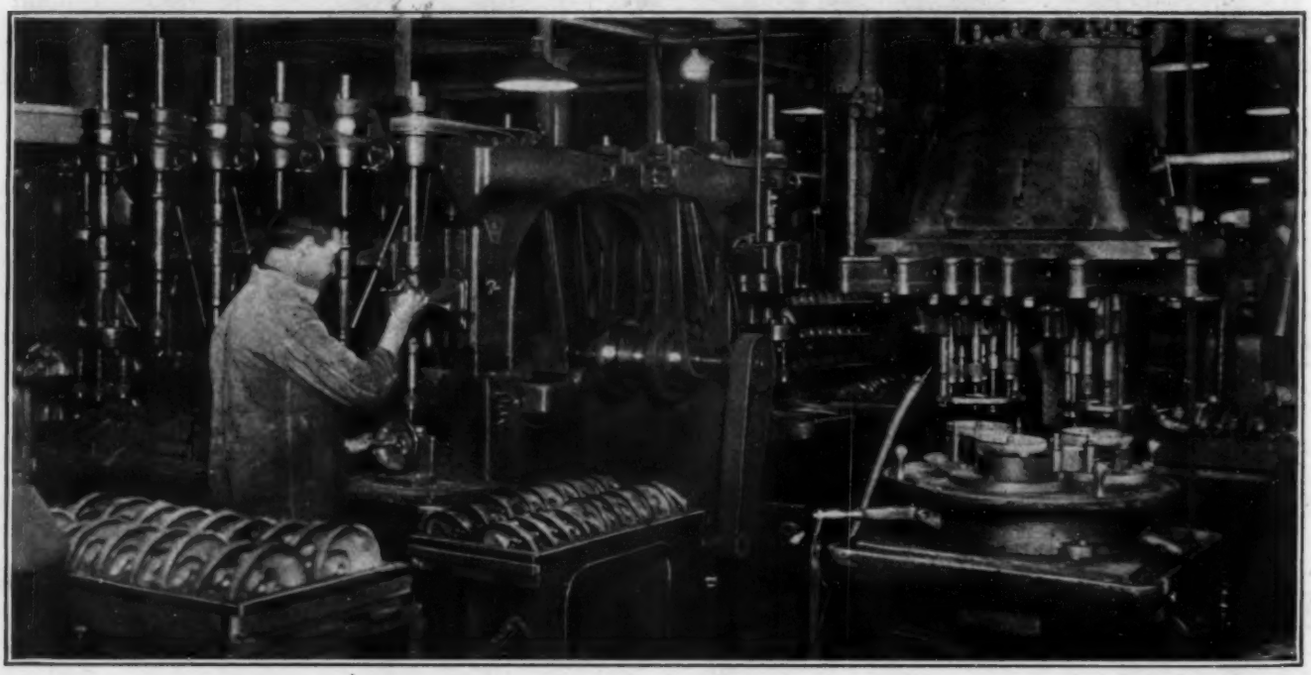
are handled by one man, and the operations are drilling the shaft hole, cutting oil grooves and reaming the shaft hole. Average production for one operator is 1,000 brackets per day of 8¾ hr. Components to be worked on are taken from the tote box shown at the left of the illustration and after the operations have been performed are put into racks, three of which are shown beside the operator's tool stand. The racks of machined brackets are stacked at the right of the drill press in a position convenient for the next operator.

The proximity of the first-operation machines, and those for the second operation, grinding, may be seen in Fig. 5. On the two Heald rotary surface grinders one operator is rough-grinding the faces of the brackets. His finished work is stacked in racks which are piled at the side of one of the grinders (foreground of the illustration), ready for the next operator, who places them, a rack at a time, on a stand between his machines.

The drilling machines shown in the background of Fig. 5 are shown at closer range in Fig. 6. It is upon them that the fourth group of operations is performed. One operator handles the Natco multiple drill and one spindle of the sensitive drill press. On the Natco, which is equipped with a three-position fixture (two working and one loading positions), the following holes are drilled: Four holes for binding studs; one drain hole; two terminal-stud holes; two lead holes; and two starting-switch mounting holes. One overhead oiler hole is drilled on the sensitive drill press. Average production on the Natco is 1,700 brackets in 8¾ hours.

Fig. 6—Third operations on brackets

Binding stud, drain, terminal stud, lead, and starting-switch mounting holes are drilled on the Natco, and the overhead oiler hole is drilled on the sensitive machine. The entire group requires but little space.



Automotive Production

Fiat Automobile Production Methods

By J. A. Lucas and F. E. Bardrof

Final operations on crankcases—Milling and drilling methods for the bottom sections—Variety of work on the assembled case and the timing gear cover

WHILE the upper section of the Fiat crankcase to which the cylinder block is attached is being machined as shown in the preceding article, the bottom section is also undergoing operations that make it ready for assembly with the upper part. The two sections are then bolted together and the final machining is done on the assembled crankcase as one piece. This method insures the accuracy of the bolt holes for the attachment of the transmission gear case and the cover for the timing gears. The flanges to which these parts are attached are also machined after the crankcase is assembled.

A number of bottom sections of crankcases are arranged for the surface milling of their top flanges in Fig. 57. The castings are held in heavy individual fixtures on the table of an Ingersoll milling machine. This is the same type of machine used on many other operations in the Lingotto plant and has been shown before in connection with the description of the work on the cylinder blocks and the upper crankcase section. For the set-up illustrated two large face milling cutters are used and the two side milling heads have been removed from the machine. The fixtures are arranged for convenient loading and unloading and are sufficiently adjustable to allow some variation in the castings.

The drilling jig illustrated in Fig. 58 is an exception to the general run, inasmuch as the jig plate is fixed in position and the work is moved under it on a sliding platen. The work is done on a multiple spindle drilling machine made by Fiat. The base of the jig has two machined V-slides on which the platen carrying the work is arranged to traverse. A rack on the bottom of the platen engages a crank-operated pinion, so that the casting can be quickly moved from under the jig plate after being drilled, and replaced by an-

This is the tenth article of the series. The ninth article was concluded on page 225, Vol. 61, No. 6.

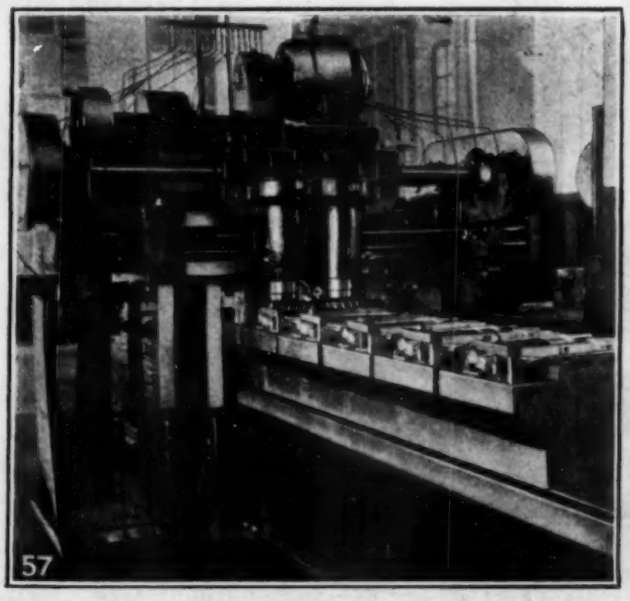


Fig. 57—Surface-milling lower crankcase section

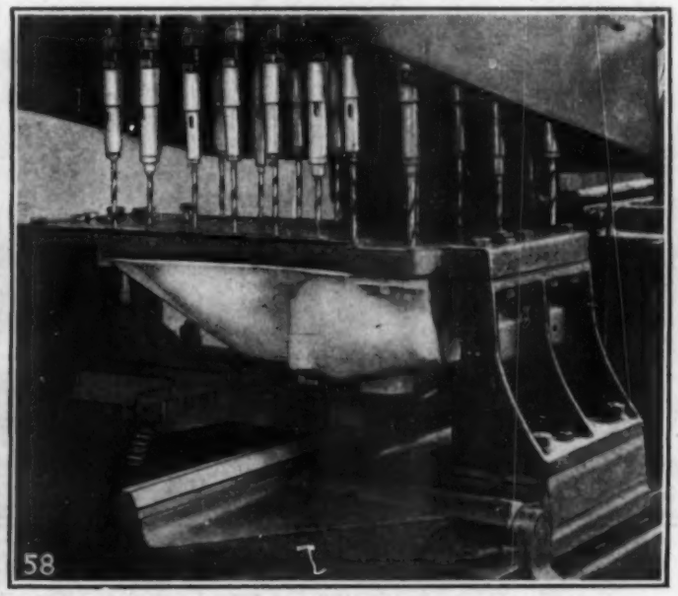
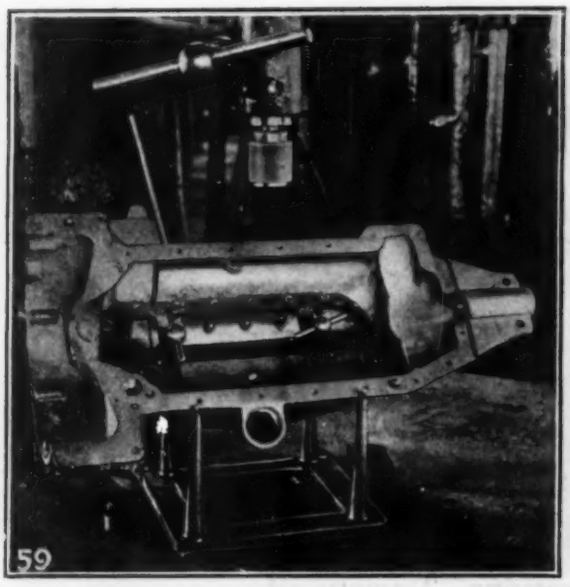
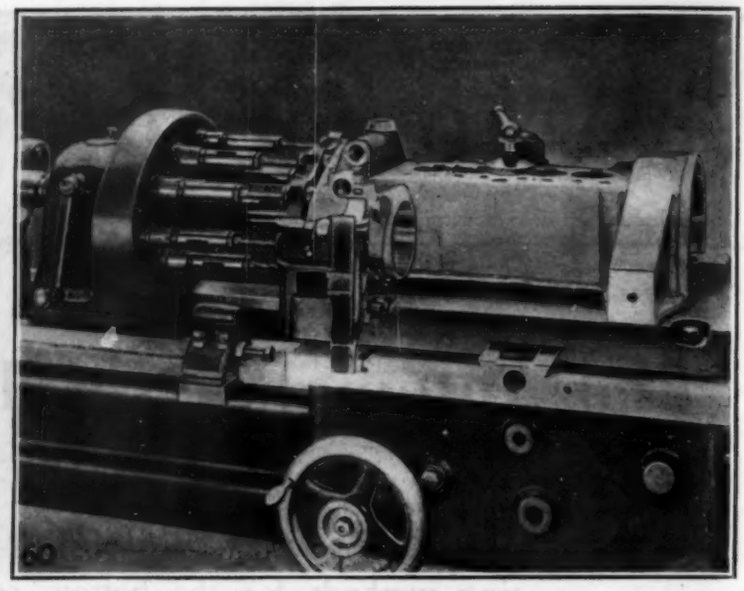
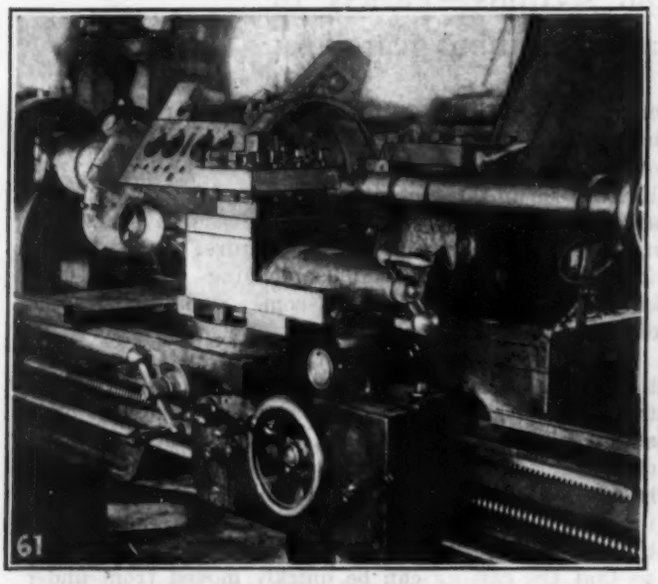
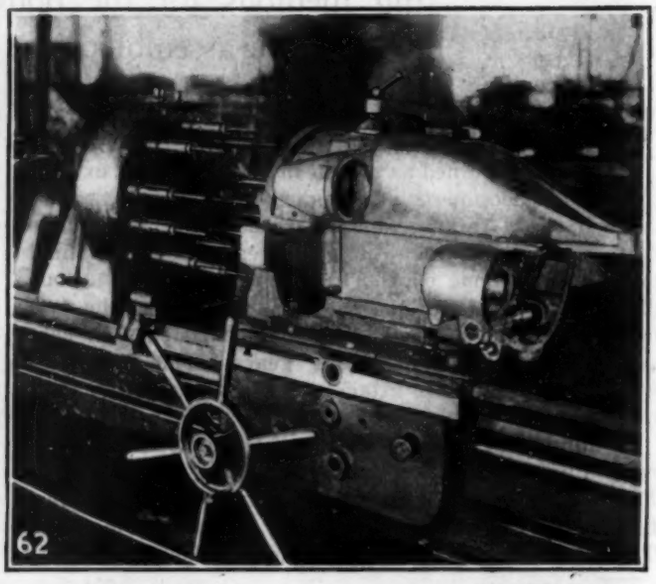


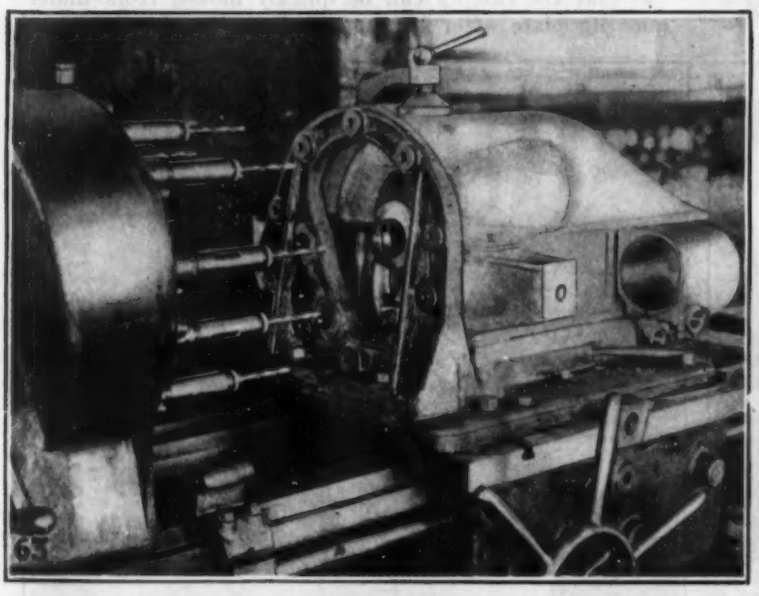
Fig. 58—Sliding platen jig for drilling bolt holes











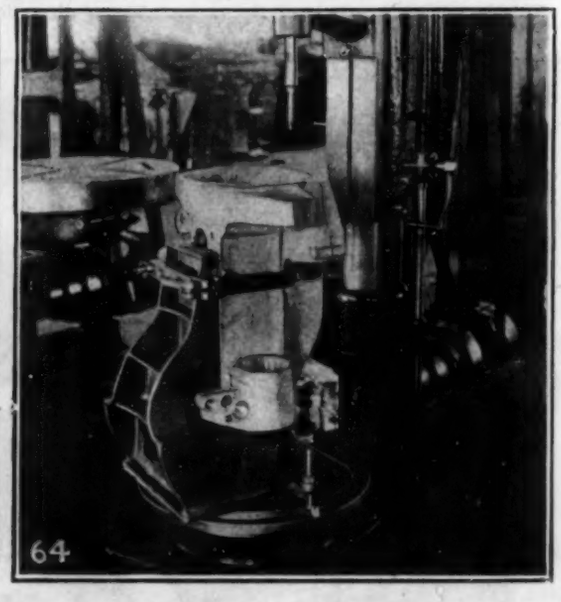


Fig. 59—Drilling jig for oil screen screw holes. Fig. 60—Front end of case drilled for timing gear cover Fig. 61—Set-up for facing the rear flanges of the crankcase. Figs. 62 and 63—Special drilling head and jig for transmission case bolt holes. Fig. 64—Counterboring transmission case bolt holes

AUTOMOTIVE PRODUCTION

other. The holes being drilled are for the bolts that hold the two crankcase sections together.

The jig inside the casting in Fig. 59 locates the holes for the screws that hold in place the screen for the oil. The case is not in position for drilling as illustrated, having been turned over part way to show the location of the jig on the work. When in position the small pins at the top of the four standards enter the bolt holes in the flange and the flange rests on the collars of the standards, holding the top of the casting level. The screen for which the screw holes are drilled re-

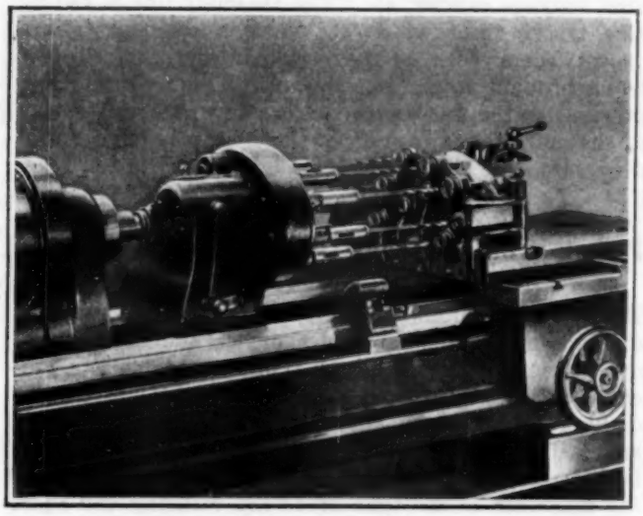


Fig. 65—Special drilling machine for timing gear covers

moves the larger particles of dirt from the oil, and the oil pump is located in the bottom of the case beneath this screen.

Before the two sections of the crankcase are assembled for the final operation, the upper section is drilled for the timing gear cover screws. This operation is illustrated in Fig. 60. The special machine on which the work is done was built at the Fiat plant, utilizing the bed, headstock and carriage of an old lathe. An auxiliary drilling head carrying the required number of drill spindles is mounted on the ways and receives its driving power from the lathe spindle. The work-holding fixture is attached to the lathe carriage and is traversed to and from the drills by hand. The depth to which the drills penetrate is determined by a stop attached to the machine bed.

The first operation on the assembled case is the facing of the flange at the rear end to which the transmission gear case is attached. A mandrel is passed through the crankshaft bearings and the case is mounted on a lathe as shown in Fig. 61. In order to increase the speed with which the work may be mounted and dismounted, the mandrel is not held on centers. A special chuck holds the spindle end and the other end simply rests in a half-bearing attached to the end of the tail spindle. The facing cut across the rear flange is then made in the usual way.

The bolt holes in the rear end of the case are also drilled on a horizontal multiple-spindle drilling machine made from an old lathe. Two views of this operation are given, Fig. 62 being a view of the drilling head and Fig. 63 a closer picture looking into the jig. The drilling head is provided with a clutch operated by means of a lever on the side of the head, so that the drill spindles are rotated only while the actual drilling is being done.

The drill holes in the rear of the case are counterbored as shown in Fig. 64 and, in contrast to the previous operation, this is performed on a single-spindle drilling machine equipped with a rotating table. The work is held in a vertical position in a suitable fixture and is clamped to the fixture by means of a band which passes clear around the case. The band is tightened by means of an eccentric clamp attached to one end, thus providing a rapid method of clamping and unclamping the work.

In Fig. 65 is illustrated another special multiple-spindle drilling machine engaged in drilling the bolt holes in the cover for the timing gears. In construction and operation this machine is similar to those already pictured and described.

Motor Shop Problems

The Epidemic of Eights

By Frank C. Hudson

THE epidemic of straight-line eights has upset the calculations of more than one production man this year. The desire for new talking points and the hope of stimulating new business has induced even the most consistent advocate of the four to join the procession, although not abandoning the four.

The eight-cylinder block involves many changes in tooling and in handling. The length may easily require moving drilling and other machines to give the necessary clearance. The arrangement of boring and reaming spindles must be changed and two more cylinders, or 30½ per cent more bores, must be ground or honed, or both.

Connecting rod, piston and piston pin capacity must be increased by one-third for the same output and the machining of an 8-throw crankshaft adds more difficulties than are represented by the increase in the number of crank pins.

Some who have studied the situation carefully are not convinced that the eight-cylinder motor is here to stay, except perhaps in a few semi-special cars. They feel that six cylinders give smooth flow of power and absence of vibration and that a six will be the standard motor for medium- and large-sized cars. Whether or not fours will continue in small cars or be replaced by toy sixes is a problem. Balance can be secured by the Lanchester method which can eliminate vibration, and many like the simplicity of a four.

From the production man's point of view either type is satisfactory if the industry will "stay put" on one or the other idea so that he can get tooled up and produce enough to get his costs down where they belong. Slight changes in design which improve performance or make repairs easier, do not upset his schedule materially. But increasing the length and weight of cylinder blocks may affect production seriously, in the matter of handling alone, even without considering the changes in tools. Other changes add further to the cost.

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Abstracts

from other publications

Reo Parts Ground Accurately

Fred B. Jacobs outlines a number of operations, particularly on the countershafts, camshafts, clutch washers and one or two gear pieces. As an example of the information he states that one type of Reo crankshaft incorporates six pins, each 2¼ in. in diameter and 1⅛ in. long with ⅛-in. fillets at the corner and four line bearings. The two center-line bearings are 2¼ in. in diameter and 1⅜ in. long, while the outer bearings are 2¼ in. in diameter, one being 3⅜ in. and the other 2¼ in. long. The back end of the shaft also includes the taper fit for the flywheel, 2⅜ in. long and 1¾ in. in diameter at the large end and two other ground portions, 1¼ in. in diameter and ¾ in. long and 1⅛ in. in diameter and 1¾ in. long. In grinding both the pins and main bearings, 0.035 in. is removed in the first roughing operation, 0.01 in. in semi-finishing and 0.008 in. in finishing.

The wheel used for roughing and semi-finishing is alundum, 26 in. in diameter, 1⅛-in. face, 36 grit, S grade, vitrified bond. It is operated normally at a peripheral travel of 6,000 ft. per min. For finishing, however, an alundum wheel in 38 grit, M grade is used. In finishing, care must be exercised to generate the correct fillet radii at the ends.

The main bearings generally are ground on Norton machines, capable of accommodating work 10 in. in diameter and 72 in. long.

Similar information is given for other parts.—*Abrasive Industry*, August, 1924, p. 193.

Fitting Bearings

Daniel Andrews, service manager of the Continental Motor Corp., discusses this month further details of bearing fitting operations, giving examples of bearings finished by various methods and pointing out why certain of them fail to give good service. Illustrations show a very poorly hand-scraped surface and one that is exceptionally well done, also a 100 per cent reamed surface and a poorly reamed surface. The effects of these in producing poor bearing surfaces is described in the text. The article proceeds to a discussion of the running-in of crankshafts and the method of end thrust adjustment used on Continental motors.—*Motor Service*, July 15, 1924, p. 21.

Quantity Production in England

This brief article describes the work of Morris Motor, Ltd., in England, although the description is in a very general way and not at all technical. It stated that in May last some 40,000 people were engaged in the production of Morris cars, starting at the raw material and ending with the assembly. The engine, gearbox and clutch units are manufactured at Coventry and at the Cowley plant the assembling, painting, equipping and testing are conducted in what is virtually a small township. It is stated that the components can be completely assembled into a car in the space of 1 hr. and 20 min. The chassis assembly would seem to follow the usual chain system. Beginning, one finds the frame as delivered by the frame manufacturers, passing through a machine which drills all the holes required in one operation. Then the frame is placed on a raised track. The mechanics work in gangs of five at each series of subsequent operations, and the rule of the factory is: one mechanic, one wrench or other tool. The front axles and wheels are the first important units, then the rear axle, the engine, steering gear complete, the muffler, dashboard, gasoline tank, radiator, luggage carrier, etc. The assembly line is fed by side tracks from which the various components are drawn, some, such as the rear-axle and engine units being brought to the line by an overhead runway and others, like the muffler, being shot down a chute. Each of the units that travel down the side lines has its own assembly line. The system parallels American construction.—*The Motor*, England, July 1, 1924, p. 942.

Possibilities of Heavy-Duty Drilling

This article by Herbert L. Tigges of Baker Bros., Toledo, Ohio, points out the possibilities of heavy-duty drilling and presents samples of work done in automobile plants. A heavy-duty drilling machine is a machine with a box column which lends itself not only to drilling operations but also to boring, forming, tapping and facing operations. One sample of work is a pump-body casting formerly done on boring, turning and milling machines in the time of 1¼ hr., utilizing 160 sq.ft. machine space. This is now done on a gang-drilling machine and in addition to the pump body being finished, the flange holes are also drilled, the whole operation consuming only 20 min. and occupying 40 sq.ft.

Similar descriptions are given of automobile connecting rods, bored and reamed, and another interesting subject is an illustration of three types of transmission housings, bored and reamed on heavy-duty drilling machines. On one of these for example, the holes are rough bored, two machines being handled by one operator, producing some 300 housings per 9-hr. day.

There are also illustrations of differential carriers bored and tapped and of a pressed-steel rear-axle housing, faced on one side and tapped on both sides.—*Machinery*, August, 1924, p. 950.

Buick Demonstrates Perfect Interchangeability

The Buick company recently demonstrated a "stunt" which is an example of present-day manufacture to tolerances by staging the assembly of various units into a complete chassis. This was done in the open public streets of several selected cities, every unit taken at random from the local dealer. The assembly was done by two men and a helper, the latter operating a small crane for the heavier units. Beginning with the frame, the two assemblers quickly mounted the axles and bearings, then followed with the wheels and brake connections, and while one man installed the steering gear, the helper lowered the engine into its place. After this followed the radiator and its connections, and soon a complete vehicle was built up, the job being done in 50 minutes.—*Motor Life*, July, 1924, p. 18.

How to Estimate Machine Shop Costs

By Albert A. Dowd

Further data on estimates for gear cutting—Use of gear shaper for internal gears—Hobbing worm gears—Examples of estimates for threaded work

INTERNAL gears can be cut with a special attachment on a gear cutting machine under certain conditions, but in other cases they must be cut on a gear shaper. In cutting spur gears, we have not considered this machine, although it is widely used. The operation of the machine is a shaping generating process, the gear being set up on an arbor or fixture so that a circular cutter formed to the contour of a pinion and suitably relieved can cut the teeth by successive strokes as both cutter and gear blank are

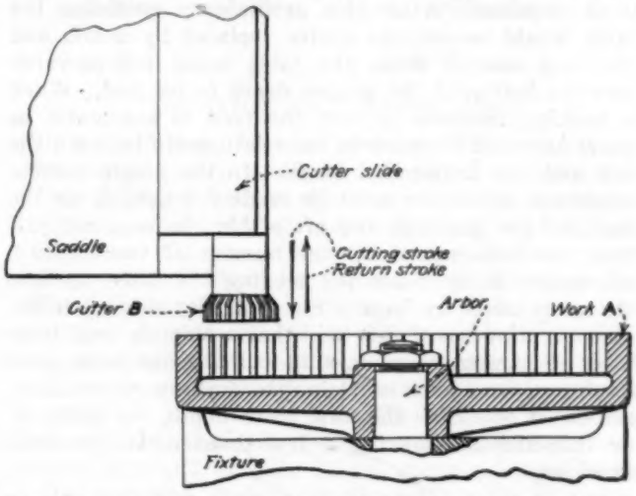


Fig. 30—Diagram illustrating action of gear shaper on an internal gear

revolved together. The diagram shown in Fig. 30 illustrates the process as applied to both external and internal gears. The gear blank shown at *A* is an internal gear set up on an arbor fixed in the table. The cutter *B* is mounted in a vertical reciprocating slide or ram, the stroke of which is adjustable to suit the conditions. The ram moves up and down and the gear is moved away from it for clearance on the return stroke. As both gear blank and pinion revolve together, a true generating action is produced. The circular cutter is gradually fed in to depth and the gear blank is revolved once to complete the piece. The speeds and feeds vary according to the material, pitch and stability of the work. Both spur and helical gears can be cut on the gear shaper, and cluster gears, such as are used in transmissions are practically impossible on any other type of machine. The example shown in Fig. 31 at *A* illustrates a cluster gear of the type mentioned and it is apparent that while a gear shaper cutter can produce the gears without difficulty as shown at *B*, a circular cutter would gash into the adjacent gear *C* and ruin it while attempting to cut the other gear. This action is clearly shown by the dotted cutter position *D*.

In estimating the time necessary for producing gears on a gear shaper we must consider first whether the work will be done on the up stroke or the down stroke. In a cluster gear or an internal gear, the cutting takes place on the down stroke, while regular spur gears are commonly cut on the up stroke. The strokes per minute vary according to the size of machine used, the smaller machines running at from 51 to 160 strokes per minute. The larger machines have speeds varying from 42 to 150 strokes per minute, the lower speeds being back-geared for heavy cutting.

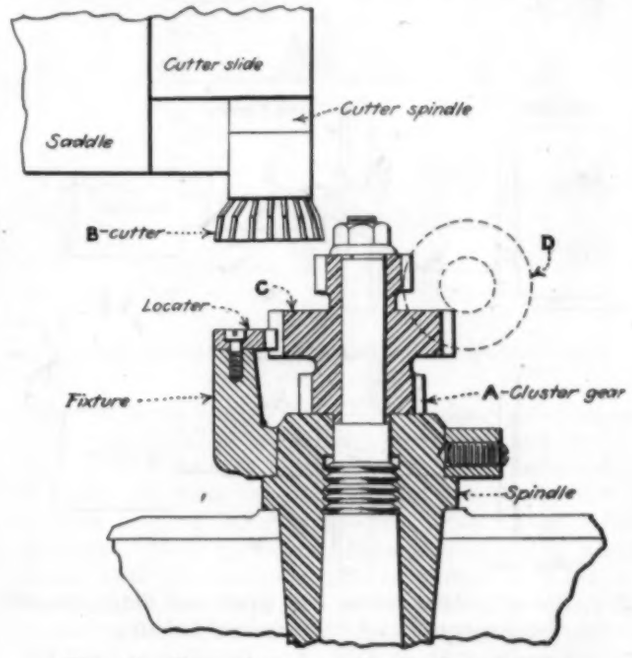


Fig. 31—Gear shaper cutting a cluster gear

In order to show the application of the estimating process to the shaping of spur gears, let us take as an example a 6-pitch, cast-iron, gear, 10 in. in pitch diameter and with 60 teeth. A gear of this kind can be cut at 216, 286, or 418 strokes per inch of pitch diameter. Hence, if we should select the coarsest feed

This is the eleventh article. The tenth article was concluded on page 230, Vol. 61, No. 6.

which is 216, we would have $216 \times 10 = 2{,}160$ strokes needed to complete the gear. If we also select a cutting speed of 160 strokes per minute, $\frac{2{,}160}{160} = 13.5$ min. for the cutting time. To this must be added setting up and removing time of approximately 2 min., which gives us a total of 15.5 min. for each gear. If we should select a feed somewhat finer the result produced would be smoother because more cuts would be taken per tooth, and the time would be correspondingly reduced.

The safest way to estimate work of this sort is to select a number of strokes per minute most suitable for the cutting speed, according to the length of the gear face and the material to be cut. Then if a very smooth product is required, the quality of finish desired can

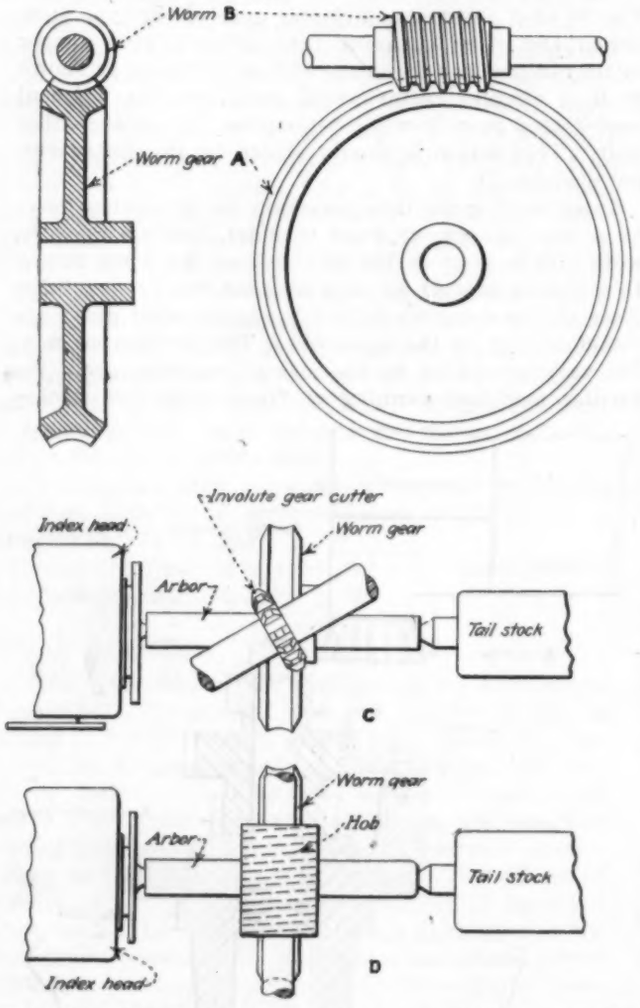


Fig. 32—Standard worm and gear and diagrammatic illustration of gashing and hobbing

be obtained by using a comparatively fine feed, governed by the number of strokes required per inch of pitch diameter. Allowance for setting up must always be made and this allowance should be from one to two minutes, depending upon the method of holding and the size of the gear blank. Very hard and tough materials require two cuts for the best results, the final cut being taken care of automatically by the setting of the machine. Due allowance must be made for the extra time necessary. Internal gears are usually cut a trifle slower than external gears.

The cutting of spiral or helical gears on a gear shaping machine presents problems very similar to those of spur gear cutting. The machine itself is also very nearly the same in its general construction and operation, provision being made for controlling the path of the cutter so that it will conform to the helix angle of the gear.

Worm Gear Hobbing Methods

Worm gears are invariably hobbed, whether one gear is required or a thousand. Fig. 32 shows diagrammatically a worm gear *A* and a worm *B*. In order that these two gears may run together smoothly, it is essential that the hob should be made to the same form as the worm, but slightly larger in order to provide the necessary clearance for smooth operation. The cutting of the worm gear should duplicate the action of the worm and gear when they are finally assembled together and in operation.

Let us assume that a single worm gear is required. It would be set up, as shown at *C*, on an index head and "gashed" at the correct angle. The operator would use for this purpose an involute gear cutter of a number and pitch corresponding to that of the wormwheel. The gear blank would be fed up into the cutter to the proper depth, allowing a small amount for final finishing, and properly indexed according to the number of teeth required. After this preliminary operation the table would be set, the cutter replaced by a hob and the final cutting done, the table being fed upwards into the hob until the proper depth is reached. When a hobbing machine is used the feed is automatic as gears are used to preserve the relationship between the hob and the wormwheel blank. In the single cutting operation, allowance must be made for setting up the machine for gashing, and after this the required cutting time determined for the number of teeth milled, allowances being made for feeding the table up into the gear blank by hand. So much depends upon the operator on work of this kind that a formula is of little use. Assuming, however, a 48-tooth bronze worm gear having a linear pitch of $1\frac{1}{2}$ in., the gashing cut would be somewhat less than the total tooth depth, say 0.430 in. or thereabouts, allowing a few thousandths for final finishing.

Time Factors in Hobbing Work

The table must be fed upward through this distance 48 times and the index head revolved as required to give the correct tooth spacing. A good workman might be able with care to make each cut in about one minute, giving a total of 48 min. for the job. If he is able to do this, he must also set up the index head, get arbors and cutters, and swivel the table to the proper angle, all of which operations consume considerable time. The actual cutting is only a small part of it and we would consider it good time if he were ready for hobbing in three hours after he started the job. After this we must allow time for re-setting the table and replacing the cutter with a hob, after which he is ready to generate the worm gear, allowing it to revolve with the hob. We should consider it an excellent piece of work if the entire job were done in five hours, including the setting up and removing time.

As another example let us assume that we have 1,000 of these gears to machine. The work would naturally be cut on a hobbing machine, the hobs being gradually fed into the gear without preliminary gashing. A

formula which can be used for this kind of work is given as follows:

$$\text{Cutting time} = \frac{D \times N}{F \times R}$$

in which

F = Feed per revolution of gear;
R = Revolutions per minute of hob;
N = Number of teeth in gear;
D = Total depth of feed necessary.

Substituting the numerical values, $\frac{0.4577 \times 48}{0.010 \times 75}$ = 29.2 min., approximately. If we allow about 2 min. for setting up the gear blank, we will have a total production time of 31.2 min. for one gear or 31,200 min. for a lot of 1,000 gears. A hob of this kind-on bronze would require re-sharpening a number of times before the job was completed and time allowance should be made to cover this, as well as the setting up and taking down of the machine. The time for hob grinding would probably be not less than one hour each for ten grindings, and to be safe it would be better to allow two hours, making 20 hours in all. The setting up and knocking down of the machine would require about 5 hours; therefore, 25 hours should be added to the production time already determined.

Total actual cutting time	=	31200 min.
Grinding of hob	=	1200 min.
Setting up machine	=	300 min.
Total	=	32700 min. or 545 hr.

Estimating on Threaded Work

If we had a single piece of cold rolled steel ½ in. in diameter on which a standard thread 1 in. long were to be cut at each end, we would naturally cut the thread by hand, using a die of proper size and correct pitch. If a number of pieces were to be threaded we would still use a die, but would probably hold the work in a collet and the die in the turret of a small hand screw machine. If the work to be done were such that several shoulders must be turned and one end threaded, and if only one or two pieces were required, we should probably do the turning and threading on an engine lathe. A number of pieces requiring turning and threading would be done on the screw machine, using a die or thread chasing attachment for the threading operation. Heavy threads of coarse pitch, square, or Acme threads might be milled, or cut on an automatic threading lathe.

The nature of the work naturally affects the method of cutting the threads to some extent, always assuming that the factory equipment is complete, so that the most approved method can be used. In a fully equipped shop we may expect to find turret lathes and screw machines, engine lathes, and thread milling machines or threading lathes of the automatic type. Hence, we must consider all these machines as production factors in threading operations.

The quantity of work to be made is extremely important, as it would not be wise to set up a thread milling machine or an automatic threading lathe for a very few pieces. Conversely, a long production job of threading would not be profitable on an engine lathe. Any machine tool designed for special work, such as threading, can not profitably be used for very small lots because of the time required for setting up and dismantling the machine. There are times, of course, in every shop when for one reason or another a machine not exactly suited to a certain piece of work may be used, when another type of machine would be better. With these problems we are not concerned, but we should know the type of machine best suited to the particular job we have in mind. Let us consider several examples of threading work and determine the machine tools most suitable.

Referring to Fig. 33, we have at *A* a very common case, simply a bar of steel threaded at one end, the other end being perfectly plain and no turning operation being necessary. The bar is quite long, but if only a few pieces are required, the cheapest way to do the job would be to cut the thread by hand with a die or, if a screw machine having a collet attachment were at once available and if an opening die with chasers could be set up quickly, the work could be held in the collet and the pieces threaded very rapidly. For a short job like this, however, it would be hard to beat the hand operation, as so much time would be consumed in setting up the machine. If 100 pieces or more were to be machined, there would be no question as to the machine to use.

There is another point also which must be thought of on the small lot—the possibility of a die not being available so that if work were required in a hurry a die could not be obtained in time to do the job. In this case the work would need to be centered and

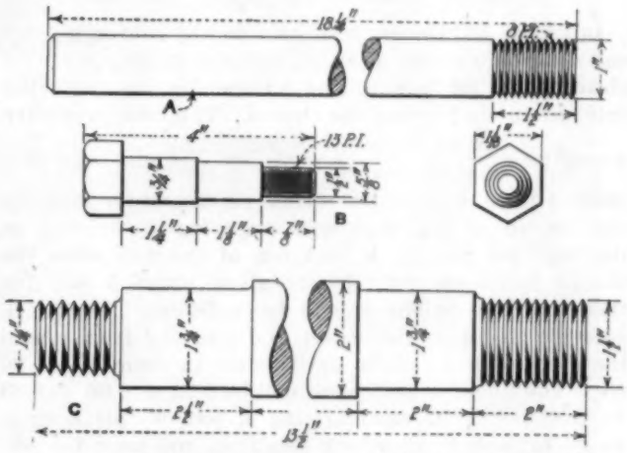


Fig. 33—Several examples of plain threaded work

threaded on an engine lathe. As in some other operations mentioned, a great deal would depend on the operator if done on a lathe. It is a very simple matter to figure the time necessary to cut the thread but it is quite another thing to produce it according to the estimate. This particular thread is 8-pitch, which means that the double depth of thread is 0.163 in. One-half of this is 0.082 in. and the depth to which the threading tool must be fed. A threading operation on this kind of material must be done at a slower cutting speed than for turning, from 25 to 35 ft. per minute being about all that is permissible. The first few chips can be much heavier than the finishing chips, but 8 or 10 "passes" will be necessary to complete the thread. The carriage of the lathe must be returned at the end of each pass and the tool fed in a trifle more each time. The total number of turns needed for the actual cutting operation would be the number of turns required to cut the length of the thread once multiplied by the number of passes made by the operator. This would only be the cutting time and would not include the

return of the carriage or incidental time in feeding the tool to proper depth.

Assuming a cutting speed of about 30 ft. per minute, the work could be run at 120 r.p.m. and if there were 10 passes, the total number of turns would be 120, as it would take 12 turns of the work for each pass. These figures, however, mean practically nothing for it takes only a few seconds to make each pass, much more time being consumed by the operator in adjusting the tool, reversing the carriage feed, etc. According to the figures given here and allowing twice the amount of time for incidentals, we have 2 min. for setting and returning of carriage and 1 min. for cutting, which would seem to prove that we could produce the work in about 3 min. As a matter of fact, the measurement of the thread and general care in the operation would probably consume from 20 to 30 min. for each piece. If the operator produced 6 pieces in 3 hours, including the setting up of his machine and incidental time, we should consider that he was doing fairly well, and it would not be safe to estimate on much less time than this for a lathe operation. In this case it is evident that an estimate based on cutting time would be practically worthless on account of the many other factors of importance which must be considered. Estimates on work of this character must be based on previous production records and long experience.

Threading Time on the Screw Machine

In lots of 100 pieces the work could be held in a collet and done on a screw machine, using a cutting speed of about 25 ft. per minute and an opening die requiring only one cut to produce the thread. The time necessary would be $\frac{\text{No. of turns of work}}{\text{Revolutions per min.}} = \frac{12}{100}$ min. To this amount must be added the time necessary for running the die up to the work and engaging it, as well as the time for putting it back out of the way when the thread has been cut. If we allow about 5 sec. for these two operations it will be sufficient. The work must be placed in the collect and removed from it and these operations can be easily done in from 15 to 20 sec. The time for each piece will be $0.12 + 0.08 + 0.33 = 0.53$ min. In summarizing a job of this sort, it would be well to allow not less than one hour for setting up the machine, in addition to the time for cutting the threads. Then the total time will be $0.53 \times 100 + 60 = 113$ min. In estimating this job it would be wise to add to this amount for contingencies at least one hour more.

This piece of work has been treated at length in order to illustrate the danger of taking a time estimate too literally without making due allowance for other factors which do not appear at first glance. The experienced man on this class of work will realize these conditions and make due allowance for them, but the novice is very likely to underestimate the time needed and thus get himself into trouble.

In the example shown at *B* we have to consider not only the cutting of a ½-in. thread, but also the turning of the ⅝- and ¾-in. diameters. The threading work here would also be done with a die head of the opening type and the various diameters would be turned with box tools or hollow mills, depending on the requirements for accuracy. In large lots this work would be done on an automatic screw machine of the multiple-spindle type and the time required would be governed by the time of the longest operation performed on the piece. As this does not happen to be the threading operation, we need only consider the turning of the ¾-in. diameter, 1¼ in. long. If a single cut is sufficient, the time will be that required for turning, at a feed of approximately 0.010 in. per revolution. To this must be added the indexing time of the machine and the approach and withdrawal of the turret. This time depends upon the type of machine used, and ordinarily it would not be over 5 sec. In this case we have a threading job where we really do not have to consider the thread at all, as far as the time estimate is concerned.

In the example *C* we have a shaft turned and threaded at both ends and it does not appear necessary to go into great detail for such a simple proposition. We must first decide upon the method of machining, assuming that the work is made up in large lots. This piece could be machined in two different ways, depending upon the accuracy required. If the two ends must be concentric, the final finishing would need to be done on centers, but if no great accuracy were required, the work could be done on a turret lathe in two operations, using an opening die for cutting the thread. For the second operation the work could be held by a previously finished surface which would be close enough for an ordinary commercial job.

On one end, the thread is 1½ diameter, 20-pitch, while the other end is 1¼ diameter, 20-pitch. The 2-in. diameter is not turned, but the 1¾-in. diameters are both finished to size with universal turning tools. The time allowance must take into consideration the turning of the 1½- and 1¾-in. diameters on one end, and the 1¼- and 1¾-in. diameters on the other, in addition to the threading operations.

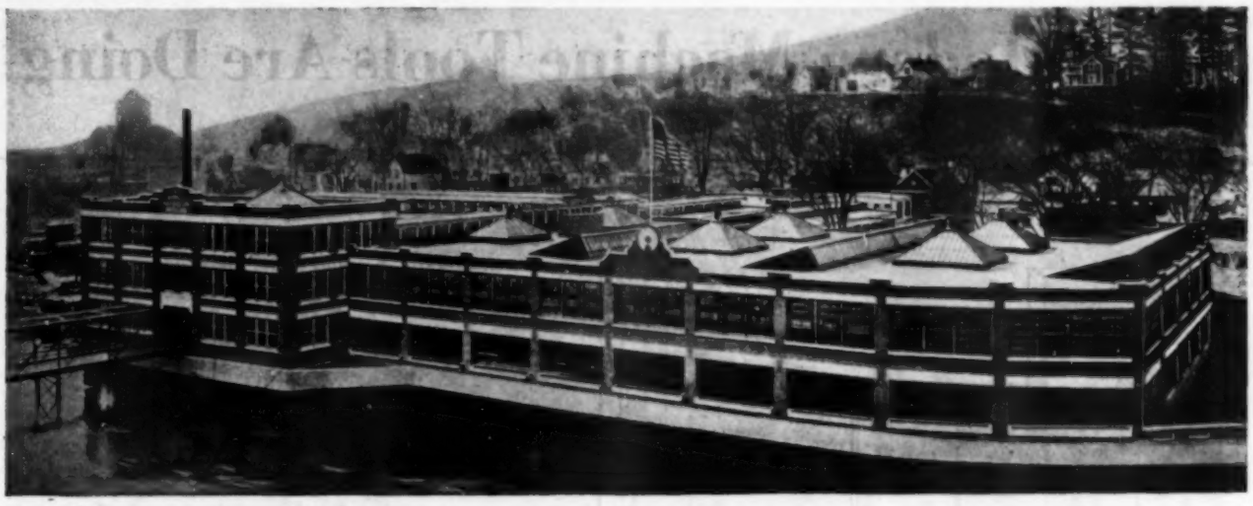
When using a diehead of the opening type in connection with other operations, time allowances must always be made for running the head up to the work and engaging it; also for drawing it back from the work. If roughing and finishing cuts on the thread are required an extra allowance must be made, but this is not usually essential unless the work is very exacting.

Selling in France

The viewpoint and even the prejudices of a customer are never overlooked by the competent salesman, states E. H. Morse in *Commerce Reports*, published by the Department of Foreign and Domestic Commerce. It is difficult to sell in a foreign country an article that does not appeal to the tastes as well as the needs of the prospective buyer.

Frenchmen demand not only quality and durability in the machinery that goes into their shops, but in many instances they insist on finish, and the manufacturer who tries to sell a customer an unattractive-looking machine is creating unnecessary sales resistance.

Frenchmen do not take kindly to whirlwind campaigns. They prefer to know what they are buying, making their own tests. They do not like to be stampeded. Advertising is commonly used and is effective, but it must take into consideration the French preferences. The American manufacturer who wants a big outlet in France should plan for a long campaign, building slowly and painstakingly. A sound merchandising campaign intelligently conducted should be profitable from the first.



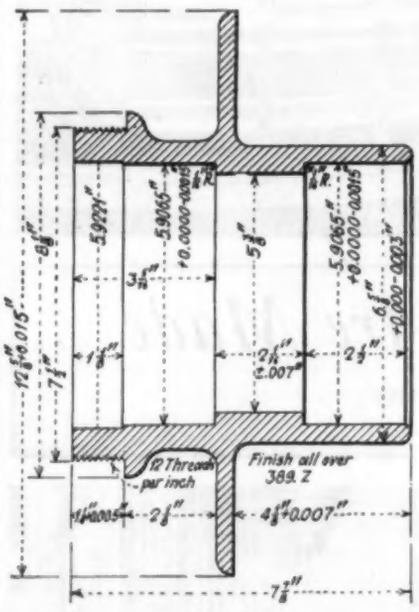
Where Machine Tools Are Made

The Fellows Gear Shaper Company

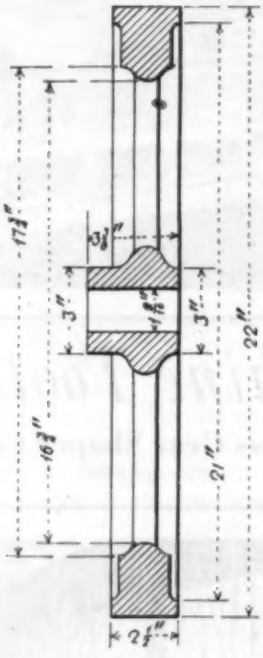
Founded 1896

What Modern Machine Tools Are Doing

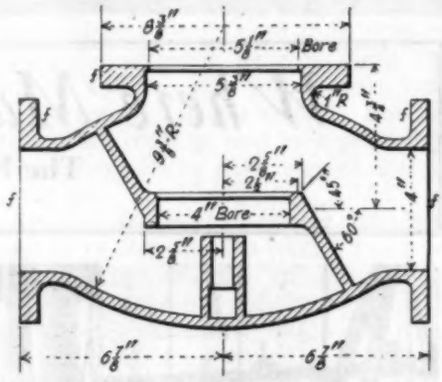
Gisholt Turret Lathe



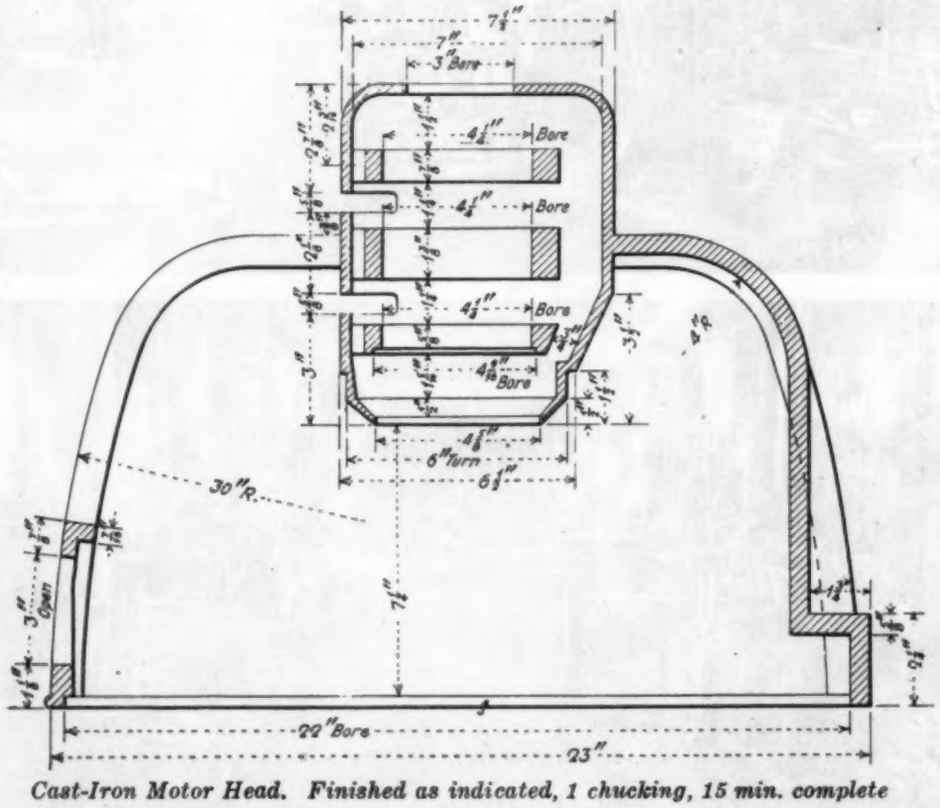
Steel Hub. Finished all over, 2 chuckings, 30 min. complete



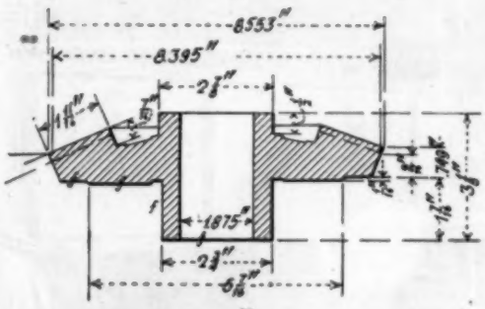
Cast-Iron Flywheel. Finished as indicated, 2 chuckings, 15 min. complete



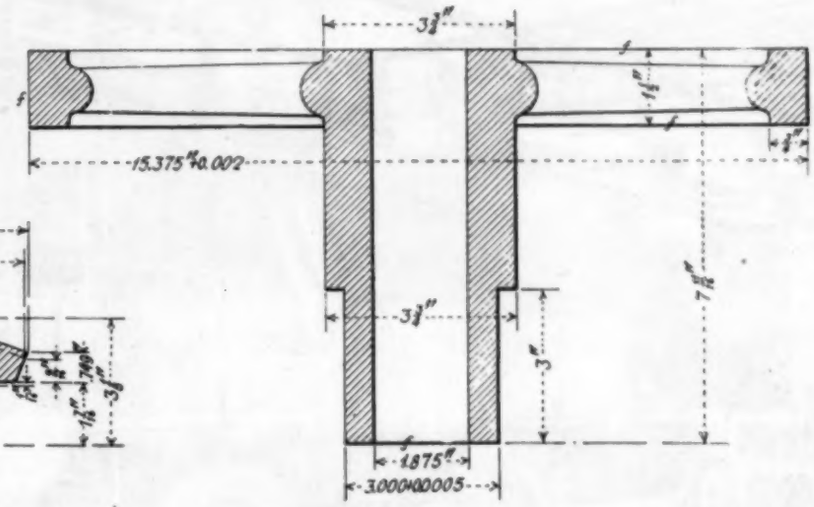
Brass Vulve-Body. Finished as indicated, 1 chucking, 25 min. complete



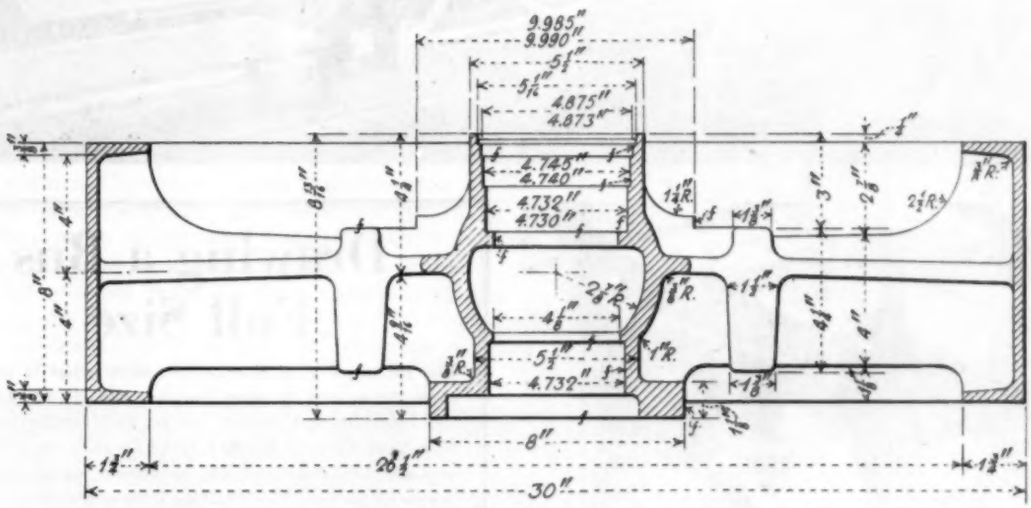
Cast-Iron Motor Head. Finished as indicated, 1 chucking, 15 min. complete



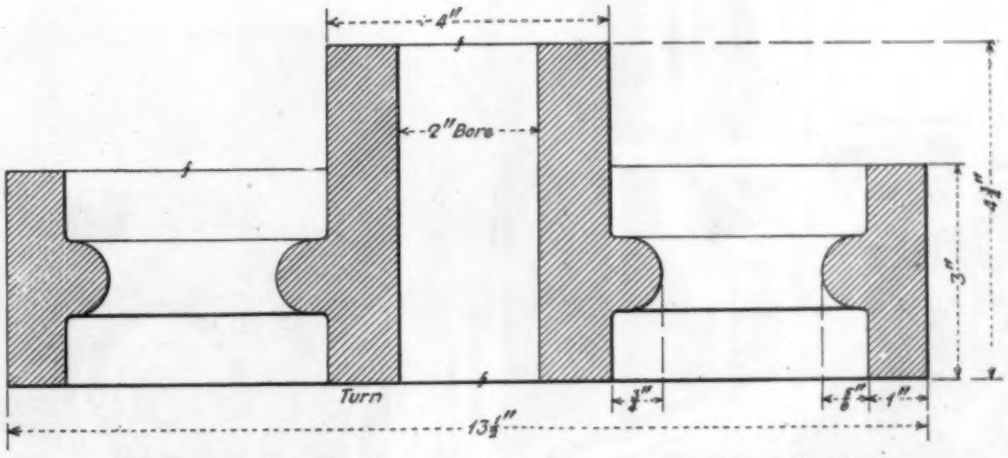
Steel Forging—Bevel-Gear Blank. Finished all over, 15 min. complete



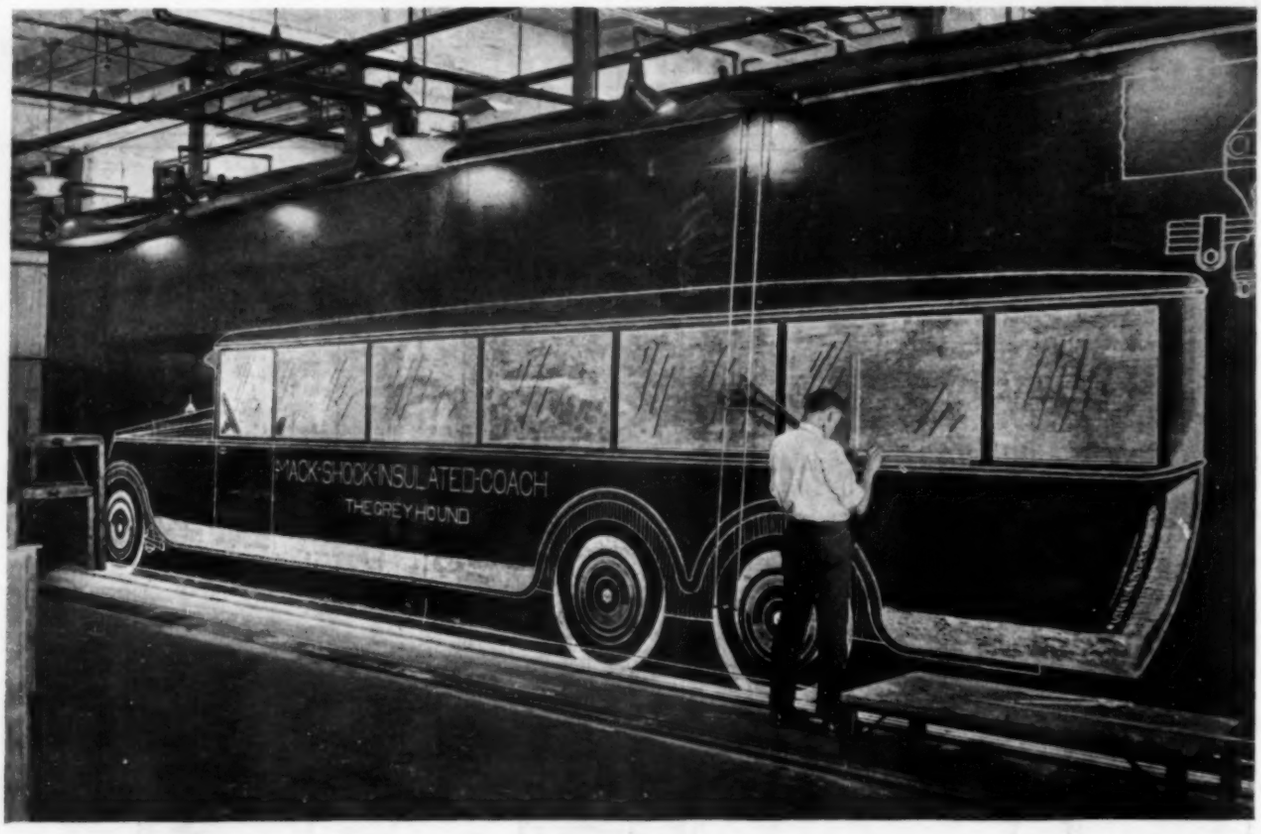
Cast-Iron Gear. Finished as indicated, 2 chuckings, 15 min. complete

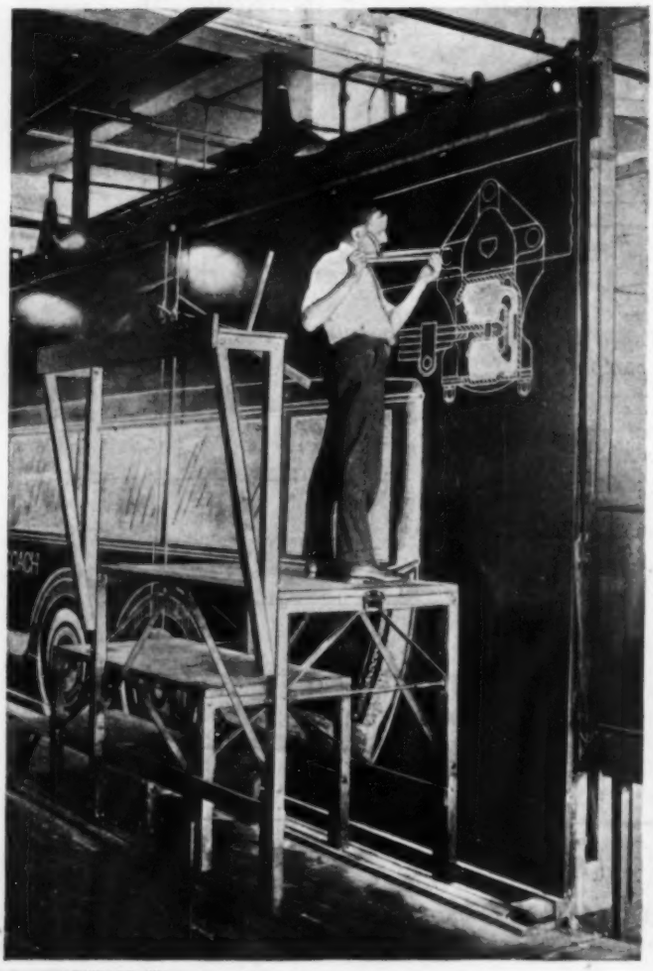


Steel Casting—Rear Truck-Wheel. Finished as indicated, 2 chuckings, 60 min. complete



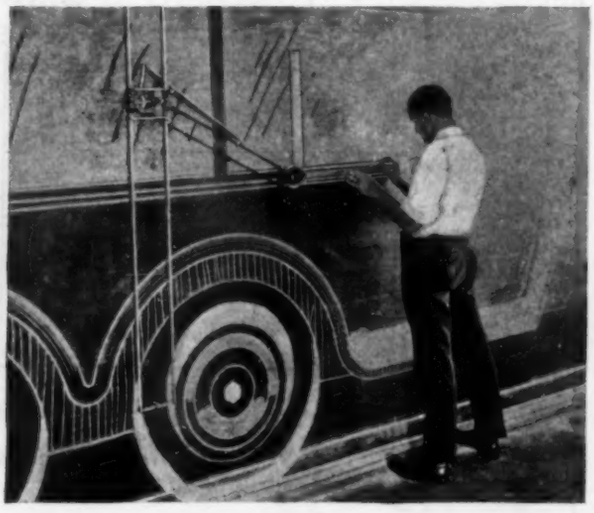
Semi-Steel Gear. Finished as indicated, 12 min. complete, 2 chuckings





Drawing a Bus Full Size

The accompanying illustrations show what is believed to be the largest drawing board in use. It was built by the International Motor Co. in its drafting room in New York City, and is 40 ft. long by 10 ft. high. Drawings are made with chalk, as shown, or on specially prepared paper. The drafting instrument is a product of the Universal Drafting Machine Co. The lighting system was designed especially for the board. A full-size layout of a 40-passenger motor bus is shown.



Drawing Small Tubes of Precious Metals

By Jack Williams

Drawing tubes of platinum and gold—Operations conducted by hand — Value of materials too great to permit waste — Successive reductions small and annealings frequent

MECHANICS, especially those having experience upon press and drawing tools, are more or less familiar with the way in which brass tubing is drawn, but the drawing of tubes from metal that is valued around $120 per *ounce* is an operation with which few people come in contact. The illustrations herewith show the tools and machines used in the laboratory of the J. M. Ney Co., Hartford, Conn., for drawing tubes of platinum and gold alloys to sizes as small as 0.0312 in. internal diameter.

The process does not differ materially from that applied to the drawing of the baser metals, but every operation must be conducted with extreme care and every particle of scrap, however minute, must be accounted for, as no particle can be so small as to be without appreciable value. With the exception of the first blanking-and-cupping operation, conducted in a small power press of standard make, the work is done by means of hand-operated tools and machines.

A cup as it comes from the power press is shown to the left on the bolster in Fig. 1, which cut illustrates the first redrawing as it is done on a Greenerd arbor press. The original cup is about 1⅞ in. diameter and 1 to 1¼ in. deep, depending somewhat upon the thickness of wall desired in the finished tube. On the opposite end of the bolster may be seen one of the redrawing dies and its corresponding punch.

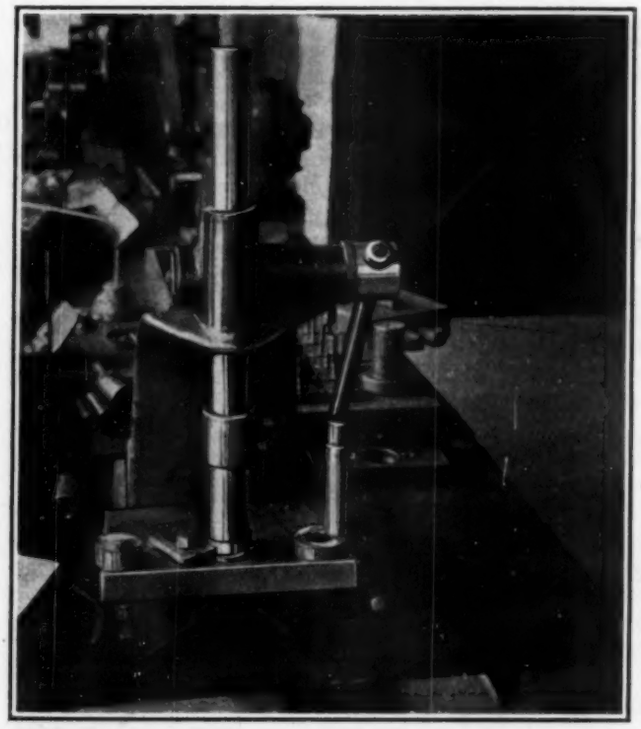


Fig. 1—Redrawing press, tools, and shell

No elaborate tool setting is necessary. The punch is held loosely by a setscrew in the collet at the lower end of the ram and the die is dropped into a recess in the bolster, which is free to float upon the anvil of the press. The clamp that may be seen at the left of the die merely holds the die in the recess, and is usually tightened only by the fingers of the operator

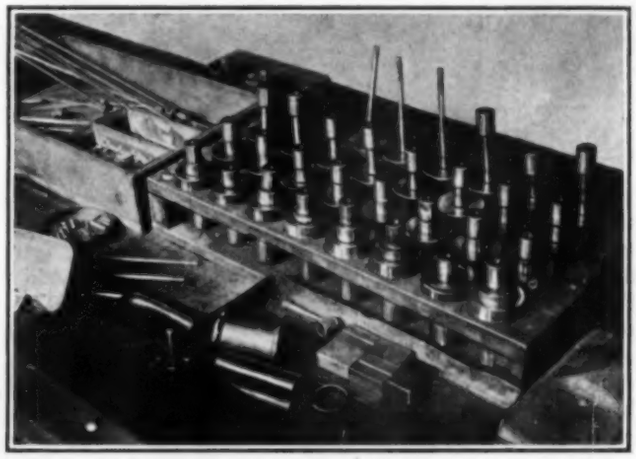


Fig. 2—The set of redrawing tools used in the press

The complete set of redrawing tools is shown in Fig. 2 so far as the operation remains one of pushing the tube through the die. With these tools the original cup is reduced to a tube about ¼ in. in diameter by six or eight inches long. Further reduction is accomplished in the machine shown in Fig. 3, which does the work by pulling instead of pushing the tube through the die. The dies used in the latter machine differ in no respect save in size from those used in the preceding operations.

The drawing machine consists of a horizontal frame having a screw-operated slide moving in carefully fitted ways over the length of its upper surface, a square-thread screw of large cross-section to move it, and a driving shaft fitted with one of a pair of bevel gears the mate to which is keyed to the screw. At the outer end of the driving shaft is a heavy balance-wheel with a conveniently projecting handle in its rim by means of which the operator may turn it.

The die fits freely into a recess in the bracket *A*, which is clamped to the extension *B* of the machine frame, and remains stationary. Farther out along the extension *B*, and still farther along the extension *C* —which was added to the original machine to increase the available length of draw—are other brackets, designed to sustain the pull upon the arbor from which the tube is being drawn. The slide on the frame of the machine is fitted with a lever-operated locknut by means of which it may be released from the screw and moved by hand to any position within its range. A toggle clamp is also a part of the slide, so arranged that the greater the tension applied, the more tightly the clamp will grip the end of the tube.

To continue the drawing from the smallest size conveniently possible by the push-through process, the

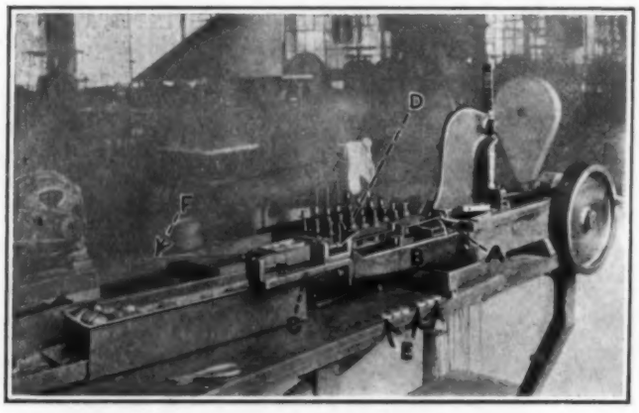


Fig. 3—The drawing machine, dies and arbors

tube is reduced for a half-inch or so of its length at the closed end to a diameter that will pass readily through the first drawing die of the machine. This preliminary reduction must be made as well before each succeeding draw, and when the tube is down to final size the repeatedly reduced end is cut off and becomes "scrap"—though its value may amount to several dollars.

The reduced end of the tube is passed through the die and gripped by the clamp upon the movable slide. An arbor of the size to which the internal diameter of the tube is to be reduced in this particular draw is inserted in the tube and a clamping bushing, *D*, Fig. 3, is adjusted upon the arbor so that when it bears against a bracket on the extension of the machine bed, the rounded end of the arbor is just within the opening of the die (inside the tube) and a minute fraction of an inch in advance of the point of smallest diameter of the hole. The exact setting of the arbor is quite important to the success of the draw, but it is more a matter of skill and judgment upon the part of the operator than of any mechanical measurement.

The handwheel is then turned, drawing the tube through the die and off the arbor. The size of the hole in the die determines the outside, and the size of the arbor the inside diameter of the product. As the tube becomes longer by repeated redrawings through dies and from arbors of successively decreasing diameters, it reaches a point where it is no longer possible to draw it all the way through within the range of movement of the machine, so the slide is unlocked and drawn back, the die, tube and arbor-bushing transferred to another pair of brackets, the slide again engaged and the drawing completed. Two feet is about the maximum length that can be drawn on this machine, but tubes of greater lengths are seldom required. Extra dies are shown on the bench at *E*, and at *F* are some of the arbors.

As shown in Fig. 3, the drawing of the tube is about one-third completed (this refers to the length of this particular draw and not to the diameter of the tube). The open end of the tube is about midway between the die and the second bracket, but as the color of the material (platinum) and of the polished-steel arbor are practically identical and the difference in their respective diameters slight, its position is difficult of observation in the picture.

Because of the intrinsic value of the material, extreme care must be exercised in every operation. Reduction in diameter between successive draws is small, amounting to but a few thousandths in many cases, and the tubes must be annealed frequently. Though every particle of scrap is scrupulously looked after, there is a definite loss in every remelting and therefore the making of scrap must be avoided to the utmost degree. The amount of reduction at each draw and the frequency of annealing depend to a large extent upon the exact nature of the alloy.

One factor that troubles the brass-tube mill does not bother the worker in precious metals to any extent —platinum and fine gold do not oxidize by heat. A piece of platinum of the brightness of polished silver may be raised to a dazzling-white heat and when cooled will be as clean and bright as it was before heating.

Pertinent Ideas on the Cutting of Threads—Discussion

BY J. T. TOWLSON
London, England

Practical men will agree with H. R. Fowler in an article under the title given above on page 573, Vol. 60, of the *American Machinist*, when he says that tap-drill sizes as given in catalogs and tap-drill lists were "established when people had more time to nurse a tap through a hole than we think we have now."

In my opinion, based upon long experience in English fitting and machine shops, there can be no substitute for expert knowledge of the conditions under which tapping is done, and these conditions are so diversified that it would be practically impossible to compile a table to cover them all.

We, who use the Whitworth, the B. A., and the Cycle thread, are aware that the tap-drill sizes given in the published lists are for a full thread in the hole, and knowledge of the actual size of drill to use for any particular hole or under any specific condition is a thing to be learned only from experience.

The proper size of tap-drill to use for a definite size of tapped hole is different when the hole is to be machine-tapped than when it is to be tapped by hand. The size varies again in accordance with the thickness of the material to be tapped. Different kinds of material require different sizes of tap-holes for the same nominal diameter of thread. Blind holes, in whatever material, need to be favored by way of larger sizes of tap-drills.

Without the least doubt there have been thousands of taps, especially of the smaller sizes, broken for the simple reason that tap-drill lists have been depended upon when expert knowledge and experience were the things most needed.

Replacement Driving Boxes on the New York Central

By L. C. Morrow
Managing Editor, *American Machinist*

Practice of the West Albany shops—Operations on driving boxes, crown brasses, shoes and wedges—Tool-setting blocks are representative of economical methods and prevent errors

REPLACEMENT parts should not be confused with parts that have been used and on which repairs are being made. In repairing some 85 locomotives per month the West Albany shops of the New York Central are afforded the opportunity of making many new parts to replace parts worn out and scrapped. The driving box is a steel casting which, with the crown brass, shoe and wedge and grease-cellar, requires both machine and hand operations.

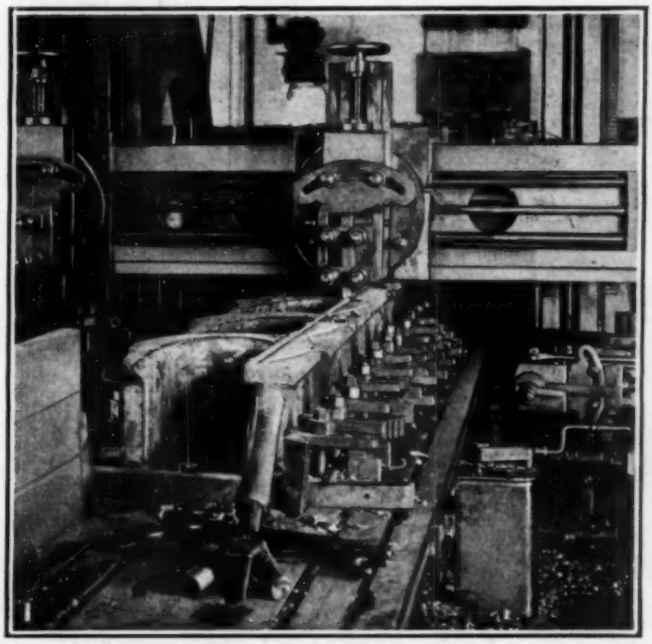
Planing of the sides is done as shown in Fig. 1, the usual number of boxes in a set-up being six. The box is then slotted for the crown brass, and the grease-cellar as shown in Fig. 2. The third operation is dovetailing the face of the box to hold the hub-plate, performed as shown in Fig. 3. In the three operations mentioned the details of set-up and tools are shown in the illustrations.

After the third operation, the crown brass is fitted to the box. Pressure of from 20 to 40 tons is used in forcing the brass into the box, the variation being due to size. The machining of the brass is done on a slotter. The difficulty of machining the brass to fit the lugs of the box is overcome by employing the gage shown in the halftone, Fig. 4, and the details of which are given in Fig. 5, a line drawing.

This gage affords an easy and quick means of scribing the bevel lines on the brass, to which lines the brass must be machined to fit the bevels of the box. There are three parts to the device, a base, a gage to fit the box, and a gage to fit the brass. The box-gage has adjustable pieces on the ends of the cross bar, which may be set to the bevel of the box and then clamped to the cross bar. The end of the axial bar bears against the top of the bore of the box while the end pieces are being set.

After the box-gage is set, it is placed on the brass-gage which is set to it. Adjustable pieces on the brass-gage are aligned with those on the box-gage and clamped. The brass-gage is then set on the brass and the bevel lines are drawn by means of a scriber.

After the crown brass is in place in the box the shoe and wedge faces and the dovetail to hold the liner are planed, the set-up for which is shown in Fig. 6. The box is then sent to the foundry where hub liner and shoe and wedge liners are cast on. From the foundry the box is returned to the planer and the shoe



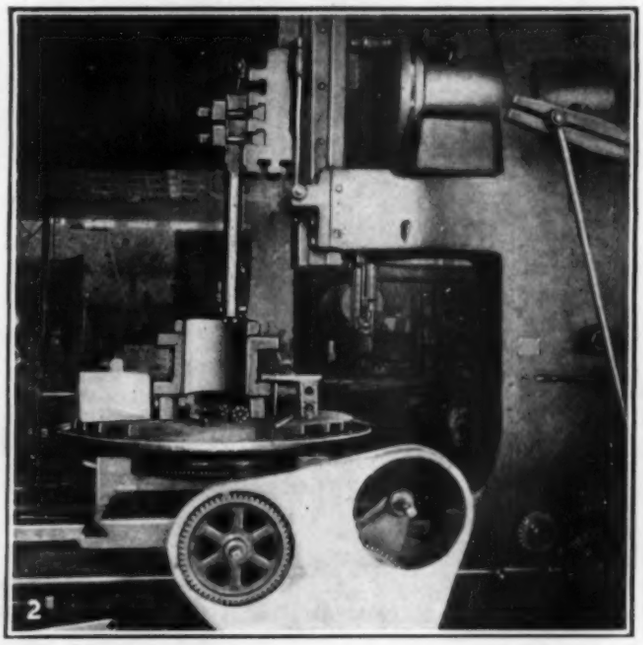


Fig. 1—Planing the sides of driving boxes. Fig. 2—Slotting for crown brass and grease-cellar

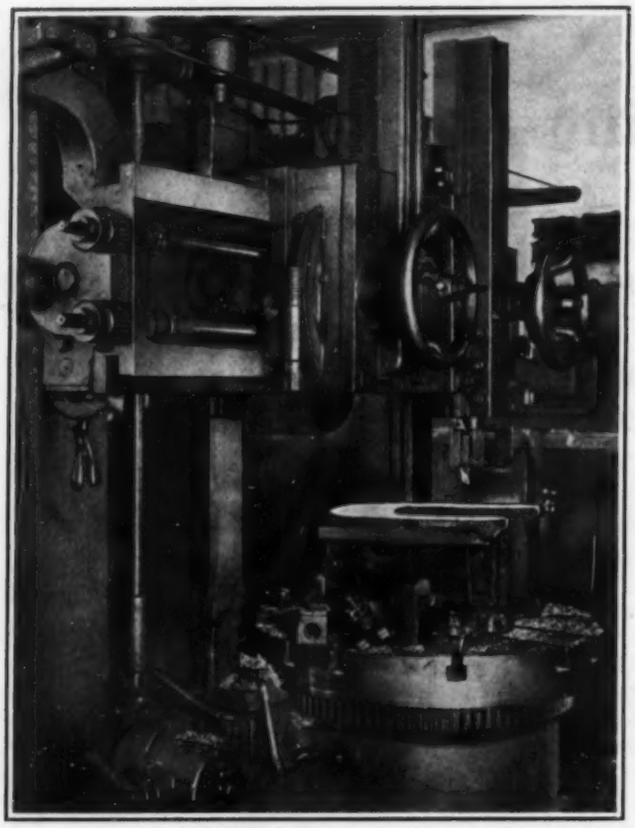


Fig. 3—Dovetailing face of box to hold hub-plate

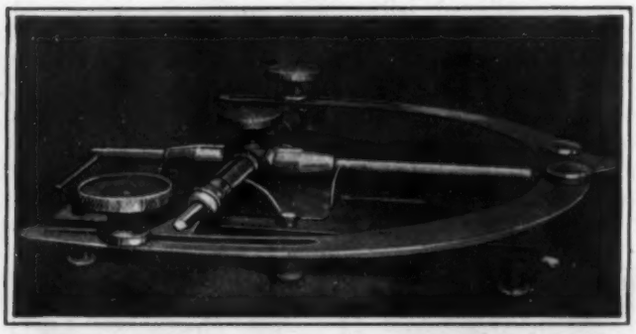


Fig. 4—Gage used in machining bevels on brasses

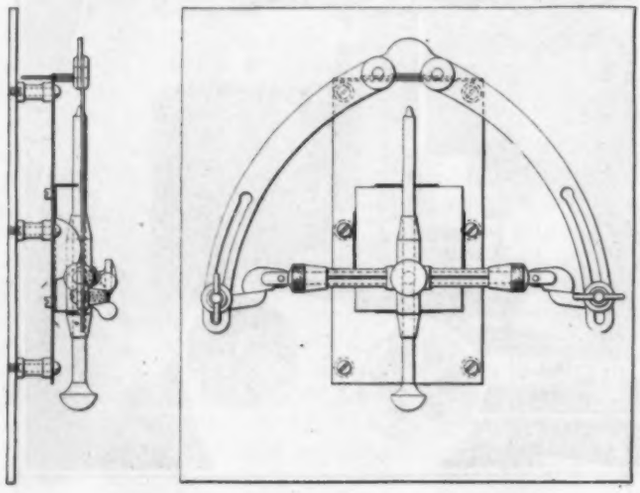


Fig. 5—Details of device shown in Fig. 4

and wedge faces are planed to standard size. In this operation a well-designed tool-setting block is used with the effect of saving a great deal of time, and minimizing the chance of error.

The driving box is clamped against an angle plate and one face is planed, the measurement being taken

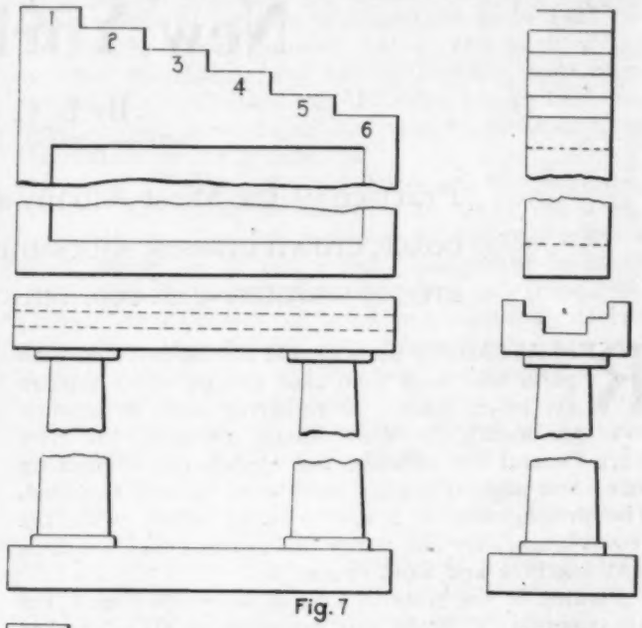


Fig. 7—Tool-setting block used in planing shoe and wedge faces to size. Fig. 9—Tool-setting block used in planing shoes and wedges

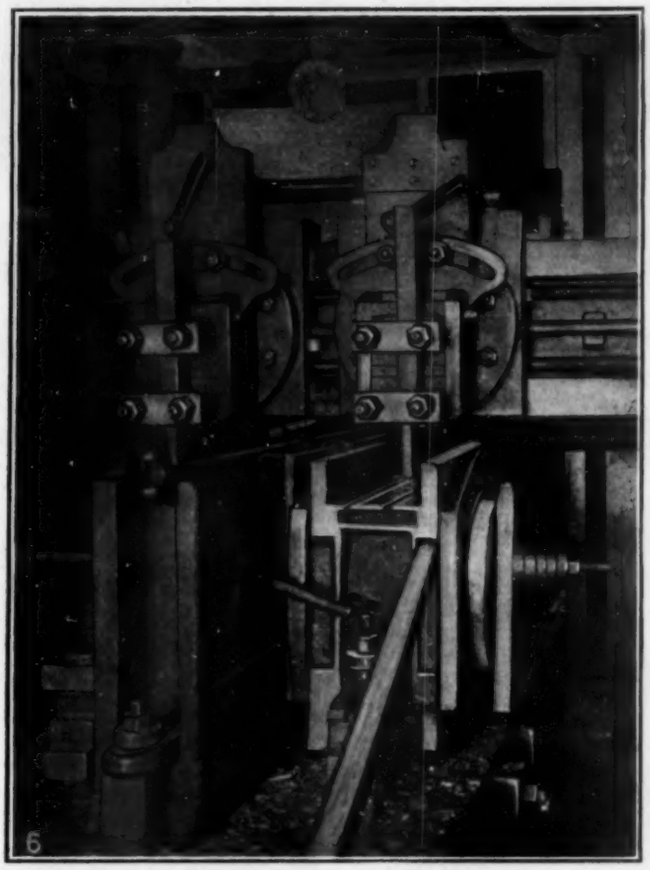
from the centerline. The driving-box is then turned over, reclamped to the angle plate, and the second face is planed, the planer tool being set to one of the surfaces, 1, 2, 3, 4, 5 or 6, of the tool-setting block shown

Engine No.....			
Box	Gage No.	Box	Gage No.
R-1	1	L-1	3
R-2	2	L-2	2
R-3	1	L-3	4
R-4	4	L-4	1

Fig. 8—Form filled out when shoe and wedge faces are planed. The information given is used in planing the shoes and wedges

in Fig. 7. The surface to be used is specified on a blueprint issued by the engineering department and listing the settings for all sizes of driving-boxes. For convenience in handling, the setting-block is made in two parts.

The planer hand fills out the form shown in Fig. 8, specifying the number of the engine on which the driving-box is to be used, whether right or left, its number, and the number of the surface used in planing it. This form is sent to the planer hand who machines the shoes and wedges, and by it he is shown what surfaces on the setting-block in his possession to use in



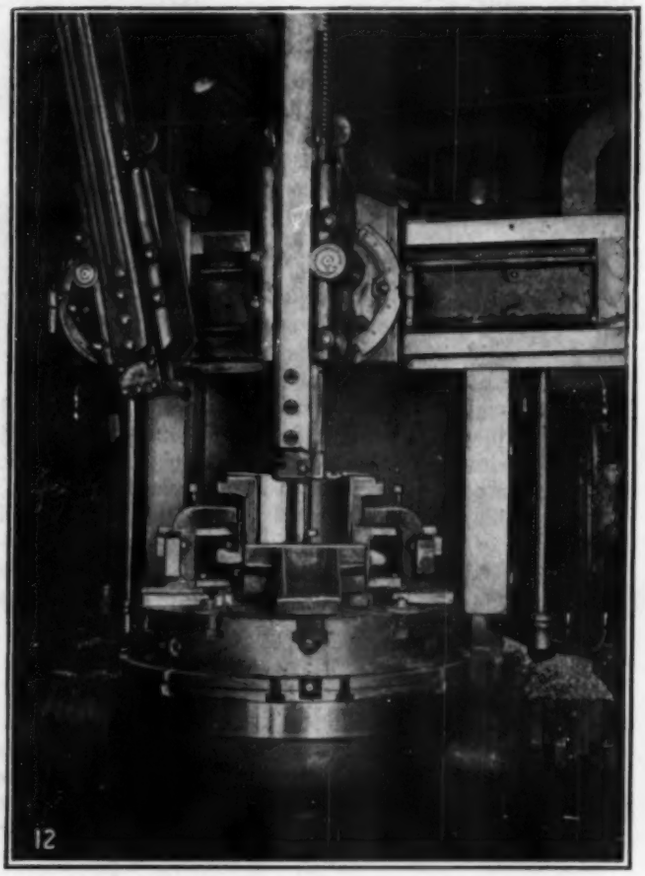


Fig. 6—First planing of shoe and wedge faces. Fig. 10—Machine, fixture and tools used in planing shoes and wedges. Fig. 11—Drilling locating holes in shoes and wedges. Note that clamps are operated by air. Fig. 12—Boring the brass to suit the driving axle and facing the hub plate

planing the shoes and wedges. The setting-block on this job is shown in Fig. 9. It differs from the other in size and design and in that the surfaces are stepped by $\frac{1}{16}$ in. instead of $\frac{1}{8}$ in., allowing half of the stock to be taken from the shoe and half from the wedge. A surface of a given number on one block corresponds to the surface of the same number on the other block.

In the operation of planing the shoes and wedges, the fixture shown in Fig. 10 is used. Roughing and finishing tools are used in the two heads. The shoe or wedge is located in the fixture on two pins that enter holes drilled by jig as shown in Fig. 11. The drill jig is located on the shoe or wedge by small conical pins that enter center punch holes pricked by the layout man. Parallels are used on the drill-press table and the jig is held to the work and the work to the table by an air-operated clamp.

Next in sequence the cellar is planed and fitted to the box, and the end plate is fitted to the cellar. Sixteen holes are then drilled in the cellar and box with the cellar in position. This work is done on a 5-ft. radial, and the holes are for the brass-holding plugs, oil cups, and the cellar fastenings. As the next operation, the brass-holding plugs are driven in.

The final machining operation is boring the brass to suit the driving axle and facing the hub plate, Fig. 12. A 40-in. boring mill with a special 2-clamp universal chuck is used. The chuck is so arranged that it can be set eccentric for machining the relief on the brass. To set the chuck off center it is necessary only to release the clamps and push it against a stop. Measuring of the diameter of the axle and the bore of the brass is done by calipers.

Oil-grooves are then chipped with an air-hammer, the box is fitted to the axle, grease is applied and the cellar is packed. The operations conclude the preparation of the replacement driving box for the frame.

In the case of driving boxes that are to be repaired, the crown brass is removed if it is oversize, and either removed or shimmed if loose. No more than $\frac{1}{16}$ in. space is permitted for shimming. Both the shimmed and new brasses have to be rebored, and the operation is the same as for replacement boxes. Worn liners are removed by planing, and worn hub plates by facing on the boring mill, new ones are cast on in the foundry and the machining operations are followed through as in the case of replacement work.

There is almost the difference between repair and replacement work that there is between jobbing and manufacturing. The repair work, since it must be done on the equipment employed for replacement parts, is responsible for irregular schedules and routing and of course in that way makes for expense. Nevertheless, it will always be necessary because of its economy of material and the saving of some of the machining operations.

Experimental Iron Blast Furnace at Minneapolis

An experimental iron blast furnace, which embodies all the best features determined by observation of the performance of other furnaces constructed by Interior Department specialists, has been completed and blown in at the Minneapolis experiment station of the Bureau of Mines. The new experimental furnace is larger than the one constructed by the Bureau of Mines at Minneapolis last year, which was the first successful experimental blast furnace in the history of metallurgy.

Crane Bearing Bracket Reclaimed by Oxyacetylene Welding

By F. E. Rogers

Crippling of a large shipyard crane through failure of a comparatively small casting may seriously affect the yard construction and repair program, and cause losses in a few day amounting to thousands of dollars.

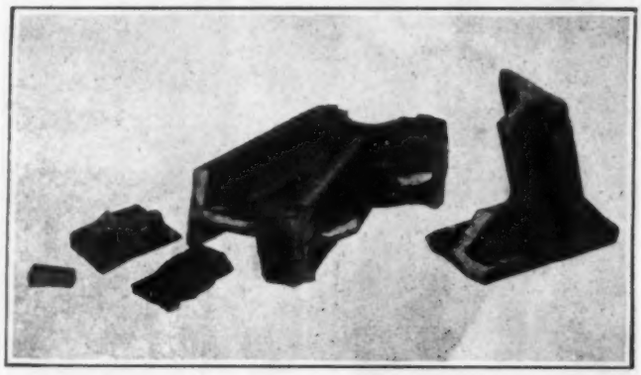


Fig. 1—Parts of broken bearing bracket ready for welding

An example is a broken bearing bracket casting belonging to a huge hammer head crane. The accident occurred when the crane was urgently needed to lift some heavy parts that could not be handled by the smaller cranes.

In Fig. 1. are shown the broken parts of the bracket. The casting was so badly shattered that there would have been little or no question of making a new one had yard conditions been normal, but to make a new bracket meant making a pattern and putting the job through the foundry and machine shop, all of which

Fig. 2—The welded bracket

would probably have taken ten days. The urgency of getting the crane into service made it necessary to repair the part quickly, and that meant welding.

The broken parts were beveled, preheated, and welded with an oxyacetylene torch, with the result shown in Fig. 2. In welding a broken casting like this, where there are several small fragments, the accepted practice is to weld the small parts first, and then assemble these with the main casting. Time and gases are saved by this procedure, and a better job is made.

Development of Machine Tools in New England

By Guy Hubbard

The twenty-second article—Christopher M. Spencer and the invention of the automatic screw machine—The progenitor of the automobile—Invention of the multiple-spindle automatic

CHRISTOPHER MINER SPENCER, whose portrait is shown in Fig. 156, was born in Manchester, Conn., in 1833, being the son of Ogden Spencer, a dealer in wool. In 1845, Christopher went to live with his grandfather, Josiah Hollister, who owned an ancient foot-power lathe with a wooden bed, which he had built himself years before, and on which he taught the boy to work.

In 1847 Spencer went to work in the mill of Cheney Brothers, South Manchester, Conn., and during his spare time he constructed a working model of a steam engine of 1-in. bore and 2-in. stroke. This engine was built entirely from information gathered from that famous old textbook, *Comstock's Philosophy*.

In 1848, Spencer entered upon a regular eight months' apprenticeship in the shop of Samuel Loomis, Manchester, Conn. The following winter he left this shop for a time in order to finish his education by attending the Wilbraham Academy. After this he served a second eight months' apprenticeship under Mr. Loomis, graduating as a journeyman machinist in the year 1849. From 1849 until 1853, Spencer worked as a journeyman machinist with Cheney Brothers, being assistant to Frank Cheney in the development of experimental machinery.

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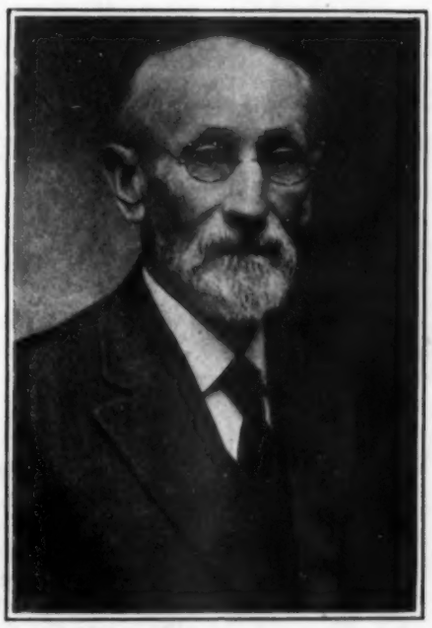
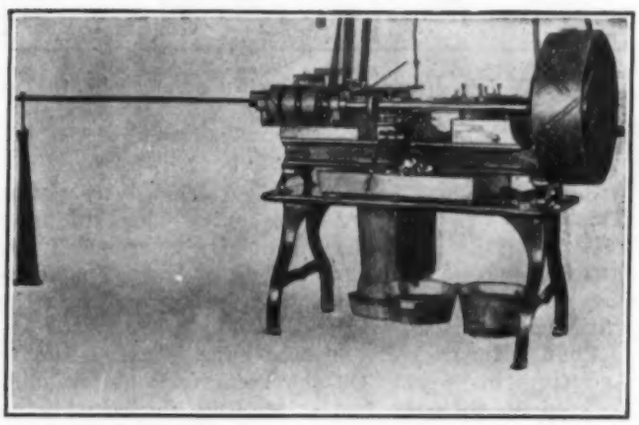


Fig. 156—Christopher M. Spencer (1833-1922)

Desiring to become better acquainted with toolmaking methods and with steam engineering, Spencer went to Rochester, N. Y., in 1853, where he remained about a year in the repair shops of the Niagara Falls division of the New York Central Railroad. He also worked for a short time on gun machinery at the shop of N. P. Ames, Chicopee Falls, Mass. Returning to Hartford in 1854, he served for two years as a gunsmith under Col. Samuel Colt. It was at Colt's that he became acquainted with his future partner, Charles E. Billings, one of the most successful of the Robbins & Lawrence apprentices, and also with George A. Fairfield, a workman from the same concern, with whom he was to be intimately associated for a number of years.

In 1856, Spencer returned to Cheney Brothers and became superintendent of the machine shop. In 1853, he invented the automatic silk-spooling machine, which released hundreds of girls from the tiresome task of winding spools by

Courtesy the Scientific American



From a photograph presented to the author by Mr. Spencer

Fig. 157—Spencer's steam carriage of 1862. Fig. 158—Spencer's original automatic turret lathe (1873)

hand. This spooling machine had a deep influence upon the thread industry, and was partly responsible for bringing the well-known Coats Thread Co. of Belfast, Ireland, to America. It was this same thread-spooling machine, as perfected by Hezekiah Conant, that Pratt & Whitney began manufacturing in its first rented room in Hartford.

In 1862, Spencer built a steam automobile which is shown in Fig. 157. To an ordinary four-wheeled buggy he added a vertical tubular-boiler and an engine. The boiler was secured at the rear and the engine at the center of the body. The tubes were made out of rejected rifle barrels, turned down to the required thickness of shell. The engine had two cylinders and the cranks were set at 90 deg., the bore being 2½ in. and the stroke 5 in. Forced draft was obtained by leading the exhaust pipe into the smokestack.

There was a chain drive to the rear axle, which rotated. Each rear wheel was provided with a ratchet, and each end of the axle carried a circular flange, and

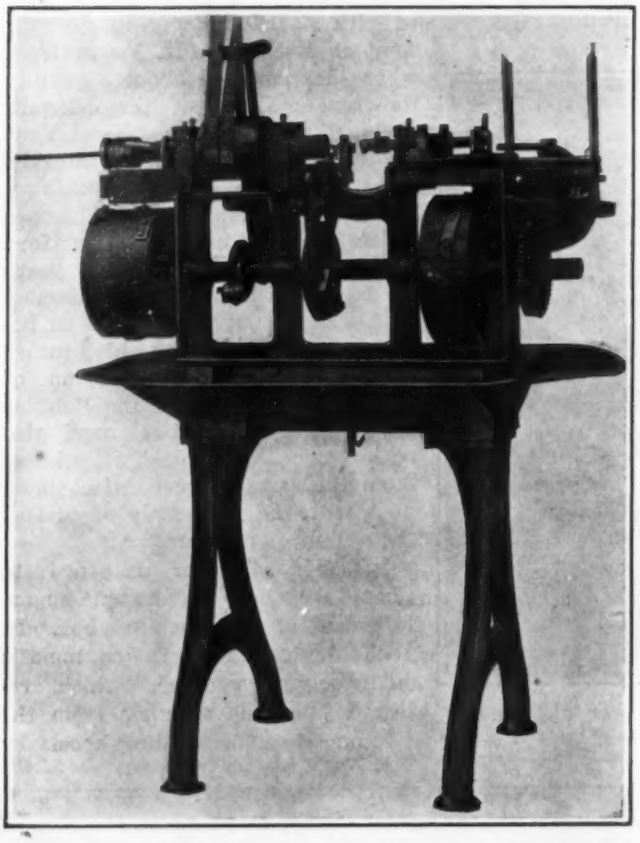


Fig. 159—The Hartford automatic screw machine as made by Pratt & Whitney under Spencer's patents
(From U. S. Census Report, 1880)

within each flange, engaging the ratchet, were pawls. This arrangement allowed the outer wheel to move faster than the inner wheel in turning a corner. There was but one speed forward and no reverse. The steering shaft carried a pinion that was geared into the "fifth wheel" of the wagon.

This steam car Mr. Spencer built to carry him to and from his work. On the race track he was able to keep up with the fastest trotting horses, while on the road his speed was limited by the rough condition of the surface. The tubular boiler, with its many tubes of small diameter, and the use of the then abnormally high steam pressure of 150 lb. to the sq.in., was a long step in advance of the current practice of that day.

Mr. Spencer's greatest invention was the automatic turret lathe, or screw machine, as it is commonly called. This machine was the direct outgrowth of experiments in automatically turning sewing-machine bobbins from bar stock, which suggested the similar rapid production of machine screws. The original Spencer automatic screw machine, illustrated in Fig. 158, was a Pratt & Whitney hand-operated turret lathe with the addition of a cam shaft, cam drums, levers, etc. It is worthy of note that this machine was a close copy of the original turret lathes built at Windsor in the late '50s by the Robbins & Lawrence Co. Spencer's first automatic was secretly built in a rented room in the loft of the old Cushman chuck shop, and after it was proved practical, George A. Fairfield, president of the Weed Sewing Machine Co., became greatly interested in it. The Hartford Machine Screw Company was organized in 1876 by Mr. Fairfield, Mr. Spencer and others, to manufacture screws and other turned parts, both standard and special, for the trade. While Spencer's was a basic invention, his patent attorney failed to grasp one of the most important features—the cam with adjustable strips, or the so-called "Protean" cam. This rather poorly drawn patent allowed the immediate entry of others into the field. The Spencer automatic, as shown in Fig. 159, was eventually put upon the market under the name of the "Hartford," the machines being manufactured by the Pratt & Whitney Co. under license of the original patents for many years.

Fig. 160—Edwin C. Henn

Edwin C. Henn, whose portrait is shown in Fig. 160, was born at New Britain, Conn., in 1863, and attended the common schools of that town until he was fourteen years of age.

For a short time after leaving school, Mr. Henn was employed by the Russell & Erwin Co. as a brass finisher, but desiring broader experience in the machinist's trade, he left home at the ege of eighteen, and went first to Lorain, Ohio, where he was employed for about five months by the Joel Hayden Brass Co. which had just been established as an offshoot of the Hayden Brass Co., Haydenville, Massachusetts.

From Lorain, Mr. Henn moved to Ludlow, Ky., where he worked several months in the shop of Post & Co., manufacturer of pullman car fittings; and next he crossed the river to Cincinnati, where for a year he was employed by the Powell Co. in making brass valves.

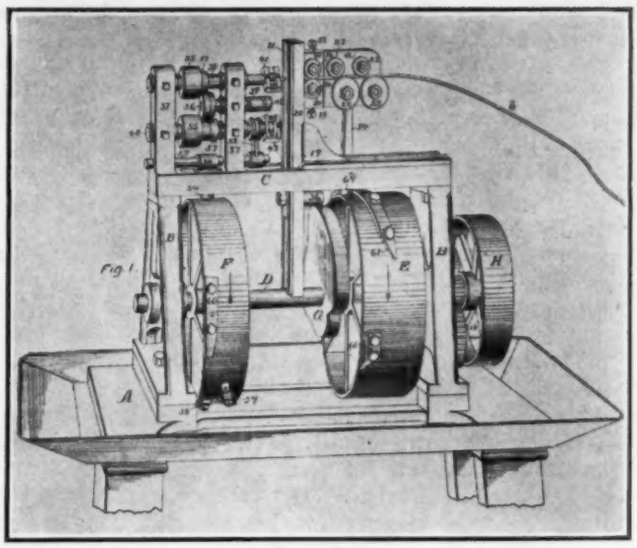


Fig. 161—The "Jumping-Jack." Built by Hakewessell & Henn in 1891

In 1883, Mr. Henn returned to New Britain on a visit and, being urged by his mother to settle down in that vicinity, he went to Hartford and obtained a position with the newly organized Pratt & Cady Co., valve and fittings manufacturer. At the age of twenty-one he became a contractor in this shop, for the production of brass valves. At that time a mechanic by the name of Loveland had a contract in the same shop for the production of iron valves, and eventually the two contractors combined their forces under the partnership name of Loveland & Henn.

They had as their toolmaker a skilled machinist by the name of Fred K. Rand, who as a boy had learned his trade in the old Cushman chuck shop. He was Mr. Cushman's model maker at the time when Christopher Spencer was constructing his first automatic screw machine in the loft of that building. Mr. Rand, who was destined to become later one of Mr. Henn's closest associates and superintendent of his company, having occasion to hire another toolmaker, selected a young man by the name of Reinhold Hakewessell.

Mr. Henn Buys Out Mr. Wittig

Reinhold Hakewessell had learned his trade at Pratt & Whitney's. While at Pratt & Cady's he and Mr. Rand invented a bevel protractor, and establishing a little shop back of the post office, Hakewessell became associated with a Pratt & Cady polisher by the name of Wittig in its manufacture. Mr. Wittig soon desired to sell out, and Mr. Henn purchased his interest. Mr. Henn and Mr. Hakewessell continued this business, as well as the building of sensitive drills and general jobbing work for about a year, Mr. Henn meanwhile carrying on his contract work at Pratt & Cady's. At the end of this period, Mr. Henn, Mr. Hakewessell and Mr. Loveland organized the Standard Manufacturing Company.

Christopher M. Spencer came to this new company with sketches of a new automatic screw machine which he had recently invented. The machine, shown in Fig. 161, was to feed the stock (as large as ⅜ in.) from a coil, and had a series of revolving tools supported in bearings in a vertical frame. The roll holder which fed the stock was mounted upon a vertical slide raised by a step cam, the different tools thus being successively brought into line with the stock. At the completion of the screw the slide was dropped back into its initial position.

The Standard Manufacturing Co. was given a contract to develop and build twenty-five of these coil machines, or "Jumping Jacks" as they were nicknamed on account of the peculiar action of the stock-feeding apparatus. The machines were duly built, and with them Mr. Spencer started the Spencer Screw Co. at Windsor, Connecticut.

The building of these "Jumping Jacks" for Mr. Spencer gave Henn and Hakewessell their first experience in the design and construction of automatic screw machines, and it served to set them thinking about the subject themselves. They became so much interested that they decided to try their hands at the invention of an improved automatic screw machine.

The problem was to design a machine that would be not only as accurate as any then existing, but which would be much faster. Mr. Spencer's coil machine suggested the solution but did not fully carry it out—this solution being multiple spindles, and the ultimate goal to have the tools all operating at once.

The idea of a multiple-spindle screw machine was not entirely new, for not only did Spencer's machine have the germ of the idea, but also some years before, such a vertical screw machine in which the bars were fed by gravity, had been constructed by Spencer's former associate, Sylvester Roper, at the Hartford Machine Screw Co. This machine did not prove successful, however, and the idea had been abandoned. Several other machines with the same idea applied to horizontal spindles had been conceived but not developed.

Designing the New Machine

Hakewessell and Henn attacked the problem in a new way, and in their earliest machine made use of the now universally used system of mounting the several spindles (four in their case) in a drum or spindle carrier which was revolved or "turned over" step by step in the headstock. A sliding horizontal-turret was provided with four tool positions opposite the four spindle positions, the turret advancing each time the spindle carrier came to rest in a new position, thus making all the tools act at once and thereby producing

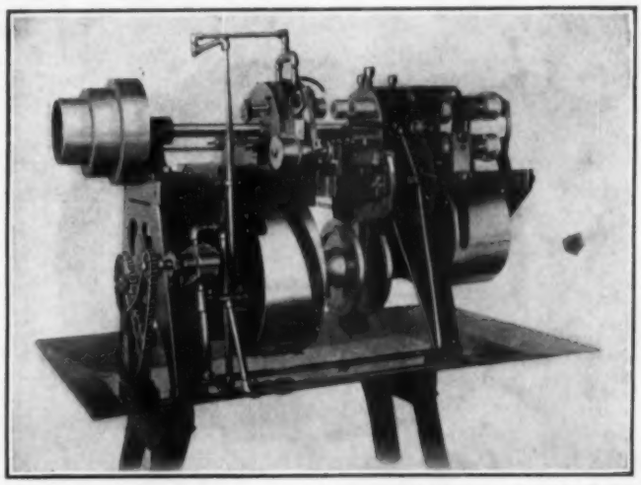


Fig. 162—The first successful multi-spindle automatic screw machine, 1893

a finished piece each time the spindle carrier made a quarter-turn. Cross-slides were provided for forming and for cutting off, as in the single-spindle machines. The turret cross-slide and stock-feeding movements were controlled by cams on drums as had been the practice on single-spindle machines but, in addition, cams controlled the unlocking, revolving, indexing and locking of the spindle carrier by pulling pins, starting and stopping an intermittent gear, and again inserting the pins at the end of the movement.

Such an experimental machine was drafted by Mr. Hakewessell and was built by Mr. Henn and himself at the shop of the Standard Manufacturing Co. It was shown to Mr. Fairfield of the Hartford Machine Screw Co. but to the dismay of the builders he called their attention to the fact that certain vital features infringed upon the patents of Allen Johnston of Ottumwa, Iowa. Investigation proved this to be true and so marked the end of this first attempt. Shortly afterward the Standard Manufacturing Co. failed.

Nothing daunted by this double catastrophe, Mr. Henn went to work under "Bill" Tucker at Pratt & Whitney's, as a demonstrator. Meanwhile he and Hakewessell had given up the shop but had moved their machinery into some of the upper rooms of the Boardman Block, and continued a jobbing business under the firm name of Hakewessell & Henn. By working at Pratt & Whitney's Mr. Henn was able to raise money enough to continue his experiments upon the multiple-spindle automatic, and the design and building of another machine was undertaken.

Improvements and Changes

This time Mr. Henn changed the design to avoid the Johnston patents, and added certain features such as a cam-operated device for stopping one of the spindles during the threading operation, and an attachment for slotting screw heads. This machine was constructed as fast as the available money would allow, not from drawings but from rough sketches and wooden models, which were often later used as patterns. In fact it may be said that it was not until long after—when five sizes of the multiple-spindle automatic were being built in considerable numbers at Cleveland—that there were any accurately made drawings and they were made from the machines, instead of the machines from the drawings. The original sketches were made upon odd pieces of paper or upon boards, and a full size rough layout was made even upon the wall of the shop. The spindle with its feeding apparatus, etc., was "laid out" by Mr. Henn by scratching with scriber and dividers upon the top of the pine table which at that time served as his desk.

During the building of this machine every cent counted, as may easily be imagined, and so many parts of it were made from pieces picked up in the scrap piles of other more prosperous Hartford concerns. Mr. Henn even had an understanding with Pratt & Whitney that he might at any time have such of their scrap or obsolete parts as suited his purpose. An instance that may be mentioned was the main cam-drum. Its size was roughly calculated, and Mr. Henn set forth with a two-foot rule to see what he could find. He finally located an obsolete cast-iron spoked pulley in Pratt & Whitney's "morgue," which after some machining became the main cam-drum of the Hakewessell and Henn automatic. While somewhere nearly correct in size, its spoked construction was not ideal for such a use and under heavy feeds it was not stiff enough to prevent some wavering of the rim.

When this first Acme (see Fig. 162), as the inventors christened their creation, was finished, and when after some experimenting and changes it had been made to work satisfactorily, attempts were made to raise money upon it. The first idea was to sell the patents, and with this in mind both Mr. Fairfield of the Hartford Machine Screw Co. and Mr. Glover of the Corbin Screw Co. were invited in to see the "Acme." While both these gentlemen conceded that it was an excellent machine, they told the inventors that as far as automatics went, they had been "through the mill," and that there was "nothing in it." They advised the inventors to give up the idea. E. C. Henn then made a trip to Cleveland and approached Mr. Warner of the Warner & Swasey Co. with scarcely better success. While in Cleveland, Mr. Henn did succeed, however, in interesting his brother, Albert W. Henn who was at that time employed as bookkeeper in the department store of Levy & Stearn, and who was a young business man of keen foresight. He had such faith in his brother's mechanical ability and in the "Acme" that he put almost his entire savings into the business, which was then incorporated as the Acme Machine Screw Company.

Guards for Planer Belts—Discussion

By Arthur Galster

On page 709, Vol. 60, of the *American Machinist* there is an article by Donald A. Hampson in which he seems to recommend wooden guards for planer belts. Being in the business of manufacturing wire mesh guards and being quite familiar with the objections to the wooden product, the writer naturally takes exception to Mr. Hampson's statements.

In the first place a wooden guard around countershafts or beling of any kind is the best little fire hazard that could be invented. The safety division of any fire department will tell you this. The insurance companies are continually fighting this kind of "protection."

The neat little cubby-hole pictured in Mr. Hampson's article is a good place for dirt to collect in, for unthinking workmen to hide articles that they do not want seen around the shop, perhaps a catch-all for oily rags or waste that may start a fire by spontaneous combustion, the hazard of which is greatly increased by the presence of rapidly moving pulleys and belts, many of which latter may carry static electricity. This argument alone is enough to condemn any wooden guard.

Another serious objection is that these guards are naturally dark inside. A man not familiar with the belts would be quite apt to reach inside for the purpose of cleaning off possible dirt or grease, and would thus be in danger of serious injury to his hand or arm.

The article above mentioned describes this as a "better-than-usual" guard for planer belts. I should unhesitatingly place this guard in the "worse-than-usual" class, and my reason for doing so is that we no longer find it necessary to fight the wooden guard, but the *make-shift* steel guard.

A full-sized door can be provided for a wire mesh guard quite as easily as for a wooden guard. Round-edged slots can also be provided to allow for shifting belts without causing undue wear. A mesh guard properly constructed is not frail and is, in my opinion, less unsightly than a wooden one.

Methods of Machine Tool Design

By A. L. De Leeuw
Consulting Editor, *American Machinist*

Continuing the subject of feeds with special reference to intermittent feeds—Star ratchet and friction types—Methods of making adjustments

INTERMITTENT FEEDS are used on a number of machine tools, such as planers, slotters, shapers, wheel lathes and others. An intermittent feed is the natural arrangement for machines where the work or the tool has a reciprocating motion. We should naturally expect the feed on a planer or slotter to take place either at the completion of the cutting stroke or before its beginning. Some form of intermittent feed is also used where neither work nor tool has a reciprocating motion, but where the work is of such a nature that a continuous feed is not necessary. In such cases an intermittent feed may be accomplished with a much simpler arrangement than would be required for a continuous feed.

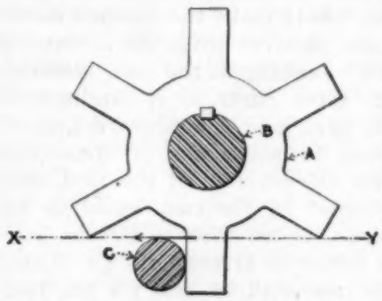


Fig. 212—Diagram of star feed mechanism

The simplest kind of intermittent feed is probably the "star" feed. In this arrangement a star is mounted on the feed screw or perhaps on a shaft which drives the screw, or maybe on some other shaft which, through gearing, transmits the motion to a rack pinion. The essential of this arrangement is the star, which is merely a piece of cast iron or steel in the form of a hub with a number of short arms projecting from it, and is actuated by a stationary finger.

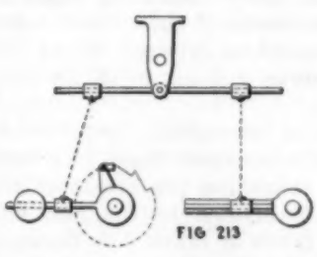
As an illustration we may take a facing head on some boring machines. The facing head rotates, and as it comes to a certain point one of the fingers of the star strikes the stationary finger which revolves the star through a definite angle. This causes the screw or other feeding member to advance the tool. Fig. 212 shows the main elements of the star feed in diagrammatic form. *A* is the star which is in some way fastened to screw or shaft *B*. *C* is the stationary finger shown in cross-section. The star travels with the facing head, or whatever device it is attached to, and advances in a plane at right angles to the paper, the direction of the plane being shown by the line *XY*. As the star travels in the direction of the arrow, the stationary finger turns one of the arms of the star until this arm passes.

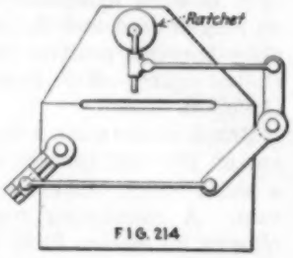
According to whether the finger is nearer to or farther away from the center of the star, the angle through which the star must pass is more or less. It will readily be seen that if the finger were too far away from the center, or, in other words, too near the ends of the arms, the star would turn through such a small angle that on the next turn of the facing head the finger would be entirely cleared. In other words, there would be no action on the star and therefore no feed. The finger *C*, then, should be set in such a position that it causes the star to revolve $\frac{1}{6}$ revolution if there are six arms, or $\frac{1}{5}$ revolution if there are five arms, etc. If the finger is near the hub of the star, it may well be that more than $\frac{1}{6}$ revolution is traversed the first time the finger strikes with a six-arm star, but, unless this amount is a multiple of $\frac{1}{6}$, the next cycle will produce $\frac{1}{6}$ of a turn and this will be the regular rate from that moment on. One should take care to avoid interference, which may occur if the finger is too close to the hub.

Method of Getting Greater Feed

If it is necessary to have more than $\frac{1}{6}$ revolution of the screw (we are speaking here of a six-arm star), then the thing to do is to place more than one finger in the path of the star and have these fingers so far apart that the first one is entirely out of action before the second one is reached. In this manner it is possible to have $\frac{2}{6}$ or $\frac{3}{6}$ or any multiple of $\frac{1}{6}$ revolution of the star. This arrangement is often used where a finishing cut is taken on a facing head of a large boring machine, such as a cylinder boring machine.

An intermittent feed which was universally used on





Figs. 213 and 214—Old and new arrangements of ratchet head

driving and car wheel lathes and is even now found quite commonly, is a ratchet feed operated either from the countershaft or from some crank arm of the machine. In the older arrangements the ratchet was operated from an oscillating arm fastened to a shaft which was pivoted in the hangers of the countershaft. A chain or cable connected this arm with the ratchet that operated the feed screw of the tool rest. Somewhere else on the oscillating shaft was another arm from which a chain or cable descended to a block which could slide in a crank arm fastened to one of the shafts

of the headstock. Every revolution of this shaft would cause an oscillating motion of the upper shaft which, in its turn, would cause an oscillating motion of the ratchet.

Suppose the shaft in the headstock were making five revolutions for one revolution of the spindle, then there would be five oscillations of the ratchet for every turn of the work. Quite often a machine was so arranged that the feed driving shaft did not make an integer number of turns of the spindle, so that there would not be five oscillations of the ratchet per revolution of the work but, say, 5½. As a result, the feed would

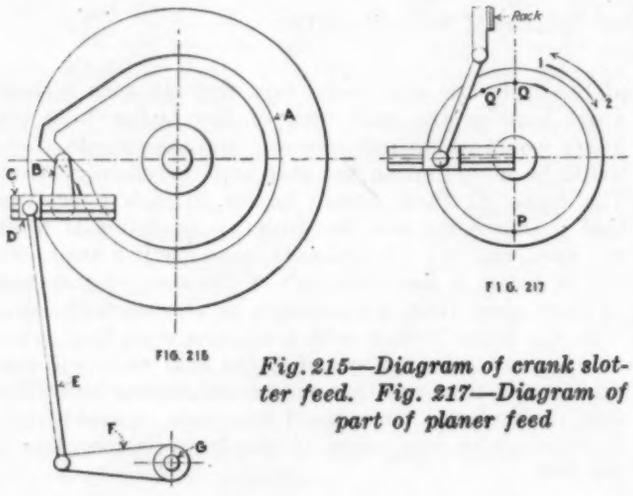


Fig. 215—Diagram of crank slotter feed. Fig. 217—Diagram of part of planer feed

take place at various points on the circumference of the work, thus avoiding, to a certain extent, the visible mark left by the feeding of the tool. However, this point was not important because on such lathes the oscillating feed was only used for roughing while the finishing was generally done by means of a form tool which was forced into the work by hand feed. The adjustable block on the crank arm provided means for increasing or decreasing the amount of feed, so that it was possible to feed the ratchet one or two or three notches as might be necessary. Fig. 213 shows in diagrammatic form the elements of this feed.

In modern machines the upper oscillating shaft is no longer used and the movement of the ratchet takes place through positive connections between it and the slotted crank. Fig. 214 shows a diagram of the construction used.

Crank slotters use a type of intermittent feed dependent on the fact that in such machines there is always a shaft which makes one revolution per stroke of the ram. A connecting rod is pivoted to the ram and obtains its motion from a crank or crank disk fastened to a shaft, driven by means of a large gear wheel. There is a cam groove cut on the face of the wheel. By far the greater part of the cam groove is concentric, but during a few degrees of its revolution an up and down motion is given to a roller attached to a lever. The arrangement of cam groove and roller is shown in Fig. 215.

As will be seen, there is a slotted crank on the hub of the roller arm which serves to modify the amount as well as the direction of the motion of a rod which is hinged to an arm fastened to a shaft. *A* represents the cam part of the wheel. *B* is the arm carrying the roller. *C* is the double-slotted crank. *D* is a block sliding in it, and attached to a rod *E*. This rod in its turn is connected to the crank arm *F* which gives an oscillating motion to the shaft *G*. This shaft operates ratchets for the various slides on the machine.

As the wheel makes exactly one revolution for the stroke of the ram, it is possible to have the feed take place at any point of that stroke by locating the cam part properly. Of course, in a slotter the feed should take place at the top end of the stroke and the cam portion is so placed, if properly located, that equal amounts of distance of up stroke and down stroke are required for the completion of the feed. This necessitates placing the center line of the cam portion in the same plane with the center line of the slotted crank at the other end of the driving shaft.

Why the Double Slotted Crank is Used

It might be asked why there should be a double-ended slotted crank. It would seem that it should always be possible to obtain a feed in either direction because the slotted crank makes up and down movements, either of which might be used for the actual feed. If, for instance, we should want the table of the slotter to feed to the right, we might accomplish it from the downward movement of the slotted crank, the upward movement being idle. If we should wish to reverse the feed, we would simply reverse the pawl at the ratchet, and this would make the upward movement of the slotted crank effective, while the downward movement would be idle. Looking at the cam, however, we see that there are three parts to it—an upward branch, a small curved part, and a downward branch, and if we should want to make use of these two branches of the cam for the reversal of the feed, then the entire distance occupied by the cam would be unavailable for the stroke. As we wish to lose as little time as possible, it is better to arrange things so that only one branch of the cam shall be used for the feed, let us say the left-hand branch in the illustration. The center line of the cam is the radius which divides this branch into two equal parts. The other part of the cam becomes idle now, whatever the direction of the feed, and may be made as gentle as we wish and may have any shape. The reversal of the feed is accomplished by shifting the block on the slotted arm from one side of the center to the other.

Planer and Shaper Feeds

The best-known type of intermittent feed is the one used on planers and shapers. Here again we use the ratchet feed and the amount is determined by a slotted crank, but various means are used for giving the crank its oscillating motion.

There are no great difficulties to overcome when applying such a feed to the shaper because there is always a definite relation between some rotating shaft and the movement of the ram; but in a planer where the stroke of the table may require various numbers of revolutions of any of the shafts, there is not much definite relation. A shaper, for instance, always has a shaft which makes one revolution for an oscillation of the vertical crank or, what is the same thing, for one complete stroke of the ram. But if, in a planer, we should have a driving pinion with a pitch circumference of 18 in., then a stroke of the table of 18 in. will require one revolution of the pinion. If the stroke is increased to 36 in. then two revolutions will be needed, and as it is with this pinion so it is with any of the other gears or shafts.

What is needed in a planer is some kind of mechanism which will move at the beginning or end of a stroke, but which will otherwise be stationary. One of the simplest ways to accomplish this is a friction device attached to one of the shafts of the planer. Let us imagine that the pinion shaft is selected for this purpose, that we key to it a disk and that we have another disk loosely mounted on it and pressed against the first disk by means of springs, so that the second disk will be taken along by the first one through friction. Let us imagine further that we have mounted on the second disk an arm which is made to butt against a pin at the end of a certain amount of movement. We will imagine that these pins are so located that the friction disk is able to make an oscillation of 180 deg. This device, which is shown in Fig. 216, is the friction planer feed in its simplest form. It shows the principles but not the actual construction of such feed mechanisms. There are two defects in the device as we have presented it. In the first place, we have mounted it on the wrong shaft. In the second place, we have a contrivance which is subject to a great deal of wear.

Friction Feed With Crank and Rack

If we assume that the table pinion has a fixed circumference of 18 in. and that the friction device is allowed to make ½ revolution, then the table would have to travel 9 in. for the completion of the feed. This is too much, and we would therefore have to do one of two things: either limit the angle through which the friction device is permitted to travel, or else place it on a shaft which has a relatively higher speed. We will first examine the effect of limiting the angle through which the friction device travels. In Fig. 217 we have added a slotted crank to our friction device and we have placed in the slot a block which operates a rack through a connecting rod. The dotted circle shows the path through which the block will travel, and indicates that the movement of the rack is upward and then downward. If the rack is connected to some ratchet device by means of which the feed takes place, then only one-half of the movement of the friction disk is used for the actual feed, while the other half is used to return the parts to their original position again. If we imagine that the friction disk travels in the direction of arrow No. 1 and the cutting stroke of the machine in the direction of arrow No. 2 on the return stroke, we find that at the beginning of the cutting stroke the rack goes up and then down, while at the beginning of the return stroke, the same thing happens.

If we imagine that the feed actually takes place when the rack goes up, then we have a feed at the beginning of both cutting and return strokes. This may be very objectionable when roughing cuts are taken, because the tool would have to drag over the rough part of the casting unless a proper tool-lifting device were employed. On the other hand, it might be of advantage for finishing feeds, as it would give double the amount of feed obtainable from the single movement of the friction device; so that very wide feeds would be possible.

As a rule, this double-end feed is not desirable, and planers which are provided with such an arrangement are generally so designed that one can have either the double-end or the single-end feed at the will of the operator.

There is another defect in the arrangement as shown in Fig. 217, and that is that the feed starts up at full speed. As fairly heavy masses have to be moved and as it is desirable to do this in the shortest possible time, we should arrange our feed so that the movement starts with zero velocity, comes to a maximum, and again dwindles down to zero. In other words, it should have the characteristics of a crank motion. To accomplish this we should have started at the point *P*, winding up at *Q*. When we do so, we overcome both objections at once; that is, we have now a single-end feed and we have a gentle start and finish.

Though the gentle start is very desirable, there is not quite so much advantage in the gentle finish because the friction of the parts to be moved is, as a rule,

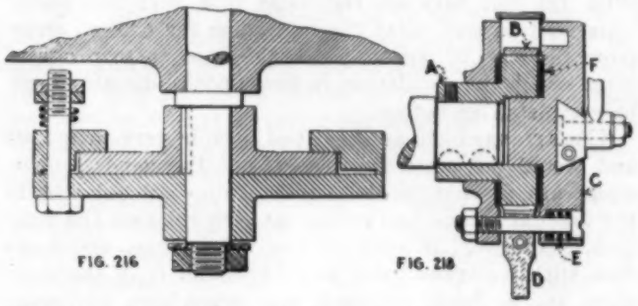


Fig. 216—Simple form of planer friction feed. Fig. 218 —Cincinnati Planer Co. friction device

sufficient to avoid shock at the end of the feed. However, it is not possible to have the one without the other. If, for instance, we could have changed the location of the point *Q* to *Q'*, we would still have had the gentle start when moving in the direction of arrow No. 1; but not longer when we move in the direction of arrow No. 2. There are cases where it is desirable to have a feed at the beginning of the return stroke, though they are very few; so that from a practical standpoint there is very little disadvantage in changing the position of the point *Q*. On the other hand, we have gained another decided advantage, because the time required for the feed is now less. Instead of 180 deg. it is, let us say, only 135 deg. If we are satisfied with the amount of time consumed for a travel of 180 deg., then it is still of some advantage to use only 135 deg. because this enables us to run the shaft on which the friction is located at only ¾ of the former speed. In other words, we have better conditions of running and that without loss of time. If, on the other hand, we desire a faster feed, then we leave the device attached to a shaft running at the speed we had in mind originally.

Excessive Wear in Unmodified Friction

The second main objection to this arrangement of friction feed is the wear which is a natural result of having the device travel all the time under friction. Suppose we should have the device so arranged that the feed takes place in 6 in. of table travel and that we have work on the planer requiring a stroke of 12 ft. Then we have the following condition: ½ revolution of the shaft on which the friction device is located takes place in 6 in. table travel, so that for one stroke there are 12 revolutions of this shaft and also 12 for the return stroke. The friction device, therefore, makes altogether 24 revolutions, out of which ½ revolution is employed usefully.

To overcome this condition such devices are modified. One modification is based on the following principle.

There are again two disks, one keyed to the shaft, the other running loose on it. The loose disk carried a brake band or clamp which grips the keyed disk. At the end of the oscillation some part of the brake construction strikes a stop. The brake band grips the feed disk through spring pressure and the striking of the stop releases this pressure, so that the keyed-on disk is free to revolve without causing any drag on the loose disk.

At the reversal of the stroke the shaft begins to revolve in the opposite direction but has no effect whatever on the loose disk or on the brake band because they are entirely free. However, there is always some little friction between the loose disk and the shaft. This friction will carry the loose disk far enough away from the stop to permit the brake band to grip again, after which the oscillation in the opposite direction will be completed as before.

The arrangement as described here is very primitive and would not work in reality, but the general principles are present, namely, that a stop not only limits the amount of the oscillation but also releases the friction. However, if nothing else were done, the loose disk with its brake band would rebound from the stop, close up, go back, rebound once more, etc., and such action of the feed mechanism will often be observed in the older planers. We see, then, that a certain amount of friction is required not only to start the device on its return stroke, but also to keep it from rebounding.

A construction in which these two frictions are embodied is shown in Fig. 218 which is a copy of the combination friction device as shown in the Cincinnati Planer Co.'s catalog. Here the keyed-on disk *A* is gripped by the brake band *B*, carried in the loose disk *C*. When the brake band is tightened the feed takes place. When the lever *D* strikes the stop it opens the brake band, though all friction is not released. The two parts of the loose disk grip the keyed-on disk by means of pressure of the springs *E* and a friction surface is provided by the leather washers *F*. This friction of the leather washers is at all times sufficient to prevent rebound and also to start the movement of the loose disk. The underlying idea of this construction is, of course, that much more power is required to move the saddles or side-heads than to start the loose disk or prevent it from rebounding, so that a small amount of friction can be used for this latter purpose—an amount so small that it is not likely to cause any trouble; whereas the heavy friction needed for the movement of the saddles would soon wear out the rubbing parts.

Many modifications of this feed mechanism have been made, in some of which a pawl and ratchet accomplished the task of starting and preventing the rebound.

Surface Appearance of Electric Steel Castings

THE progress made in the manufacture of small steel castings, which has been aided by the co-operative technical work of the five companies in the Electric Steel Founders' Research Group, has materially improved the surface appearance of the product of the steel foundry, according to the *Research Group News*. Much effort has been devoted to the elimination of the surface imperfections that formerly caused some users of castings to resort to the use of weaker metals, to secure the exterior smoothness required. In such substitutions, the superior physical properties of steel castings, such as strength, ductility, and ease of welding (when the welding process is used in assembling parts), were sacrificed for surface appearance. Such sacrifices have been needless for a considerable period, because surface imperfections have been eliminated to a great extent by careful and improved practice in producing small steel castings.

The temperature of the steel made in the electric furnace and used for pouring castings having very thin sections, is much higher than that of malleable iron and gray iron because of the different chemical composition of steel as compared to that of either of the weaker metals. The carbon content of steel for castings generally ranges from 0.18 per cent to 0.35 per cent, while that of malleable iron or gray iron is greater than 2.00 per cent. The proportion of carbon in a ferrous metal has great influence on the melting point and the degree of fluidity at a given temperature. The lower the percentage of carbon, when other conditions are approximately the same, the higher the temperature must be, to obtain the fluidity desired for pouring a prescribed thin section.

On account of this high temperature, the steel foundryman is confronted with more complex problems than is the malleable iron or gray iron foundryman. This is emphasized in the production of such steel castings as should have very smooth surfaces free from porosity, sand, and slag. Careful attention must be given the selection and mixing of molding and core sands, because the steel from the electric furnace is at a temperature near the melting point of pure silica sand, and it may have a scorifying or fusing effect on the surfaces of the mold while the latter is being filled.

In addition to the imperfections caused by the action of the steel in the mold, there are others that are due to improper methods of making and handling the steel before it is poured into the mold. The metal must be properly made and thoroughly deoxidized, or blowholes will be formed in the castings. Such cavities may also result from improper molding practice, even when the steel has been carefully made. A defect correctly attributed to poor shop practice, is the occurrence of slag spots in castings. This is frequently due to the fact that liquid slag has been entrained with the steel as it enters the mold. It is sometimes caused by fusion of materials in poorly selected or improperly prepared molding sand. The slag may appear on the surface of the casting or be hidden in its interior.

To prevent the occurrence of these and other imperfections in steel castings, technical investigations have been carried on without interruption for four years by the Research Group. The process of making steel in the electric furnace has been greatly improved, resulting in much less liability to the formation of blowholes in castings, and in continuous betterment in the physical characteristics of the metal. Advanced practice has been adopted in handling the steel to separate the slag from the metal before it is poured into the molds used for forming the castings. The selection of molding and core sands and the preparation and mixing of the ingredients in the sand mixtures, are carefully controlled and regulated, in order that castings may be produced that are free from the objectionable imperfections and roughness at one time characteristic of steel molding practice.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

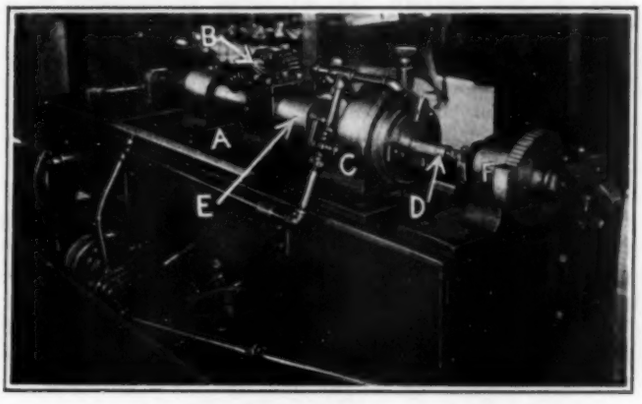
A Machine for Cutting Helical Grooves

BY MILTON WRIGHT

The helical grooving, or rifling, machine shown in the accompanying illustration was designed and built by the Eastern Machine Screw Corporation, New Haven, Conn., for use in connection with its manufacturing processes. It cuts a square-sectioned groove through the bore of the work shown in the machine.

The head *A* is given a reciprocating movement lengthwise of the bed by means of a crank and pitman, driven through worm reduction gearing.

The spindle of the head *A* has no endwise movement relative to the head itself but is rotatable in its bearings and also moves lengthwise as the head moves—the two essentials of a helix. The partial rotation to correspond with the pitch of the helix being cut is secured by the gears that may be seen to the left and back of the head. All of these gears turn upon studs or in bearings that are a part of the head and thus travel with the latter. The first gear of the train meshes with a fixed rack upon the bed of the machine, and the reciprocating movement of the head thus causes the gear train to roll back and forth.



Machine for cutting helical grooves

The rotative movement of the gears is reduced through the train and transmitted to the spindle through the helical pinion *B*, meshing with a corresponding gear keyed to the spindle. The numerous spur gears constitute not only a reduction, but a change train, so that the amplitude of the rocking movement imparted to the spindle may be given any desired proportion to the lengthwise movement of the head, thus providing means for making helices of different pitches.

The work-carrying head *C* is stationary. It carries a large-diameter spindle with a correspondingly large hole through it to accommodate different sizes of work-holding bushings. The spindle is fitted with an index plate that may have locating notches or holes to suit the particular job to which the machine is to be adapted.

The cutter-bar *D* is made to fit the hole to be splined or grooved, and is a round piece of steel having a through hole axially, a cross-hole, or slot, to suit the cutter, and a taper shank of larger diameter than itself to hold it in the chuck of the moving spindle. As the relation between the cutter-bar and the spindle must be maintained absolutely, the taper shank is splined to match a key or keys in the chuck.

The hole in the shell *E* of the chuck is smaller in diameter than the large end of the taper shank, and the shell must therefore be slipped over the bar from the opposite end before the bar is put into the machine. The shell is screwed to the body of the chuck—which is one piece with the spindle—and bears against the shoulder of the taper shank, thus forcing it into its seat and, with the help of the keys, holding the cutter-bar rigidly with relation to the spindle.

Extending through the axial hole in the cutter-bar, and passing through and projecting from the rear end of the spindle in the head *A*, is a rod of hardened steel having an inclined cam-surface at the point where it passes the crosshole, or slot, in which is the cutter. The latter is made in the form of an L-shaped lever, pivoted to the bar at one end and with the other end free to rise and fall as it is actuated by the endwise movement of the cam-rod, thus causing the cutting lip to protrude radially from the bar or to sink flush with its circumference.

The head *F* is also stationary with respect to the bed of the machine, and has its spindle fitted to the barrel with a left-hand thread so that as the spindle is turned it also advances to meet the reciprocating and rocking cutter-bar. The screw is actuated by a ratchet and pawl, the latter deriving its movement through a sliding cam and connecting rod from the reciprocating head. On the opposite end of the machine, beyond the head *A*, is another head similar to the one at *F*, but in which the screw is adjusted and locked by hand and, when once set for a job, remains stationary.

In operation, as the reciprocating head *A* nears its extreme rearward position the cam-rod is stopped by the protruding end coming in contact with the stationary spindle beyond it, while the slight remaining travel of the head *A*, carrying the cutter-bar with it, causes the cam-rod to move endwise with relation to the bar. The cutter is withdrawn into the slot in the bar by the action of the cam portion of the rod, and the cutter-bar may be pushed through the bore of the work without interference.

Near the end of the forward stroke, the cam-rod contacts with the end of the threaded spindle in the head *F* and is stopped by it while the cutter-bar still has a fraction of an inch to travel. The result of this movement is that the cam portion of the rod pushes out the lip of the cutter until it projects a few thou-

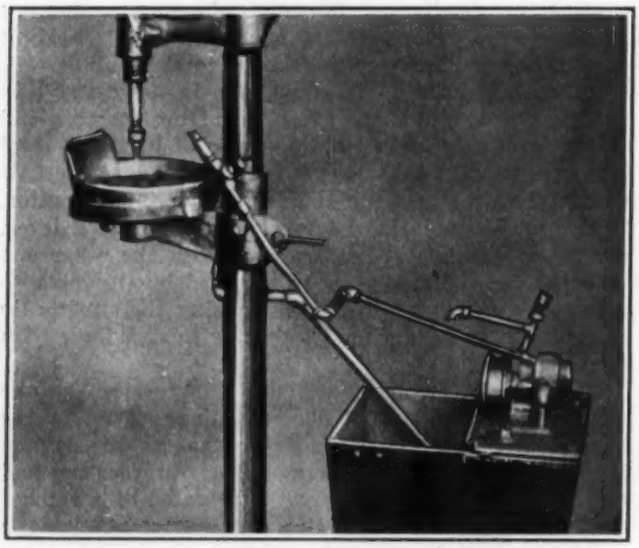
sandths of an inch above the surface of the bar; in which position it is drawn through the work, turning as it goes, and cutting the first chip from the helical groove to be made in the bore. Upon reaching the limit of its forward travel, the cutter drops back into the cross-slot in the bar as the cam-rod strikes the stationary screw as before.

Upon the second meeting of the cam-rod with the end of the spindle in head *F*, the latter has been advanced slightly by the action of the ratchet, thus imparting a somewhat greater movement of the cam-rod relative to the cutter-bar than before, and causing the lip of the cutter to project further from the bar. The amount of this increment is determined by the ratchet and pawl, and thus the "feed" is set by adjusting the pawl to take one, two, or more teeth of the ratchet at each stroke of the machine.

A Portable Pump Outfit

By Donald A. Hampson

Thousands of machine tools are in daily use that could be made to do more and better work if they had a supply of oil or cutting compound running on the tools. The older machines were not made with pump and tank and many modern ones lack them, too, for



Drill press with portable tank and pump

the reason that general purpose work does not require a supply of coolant. The makeshifts employed for these tools when doing manufacturing work consist of oil can, brush, wick, or dropped lubrication. At best these are poor substitutes because they are uncertain, time-consuming and insufficient.

The pump-and-tank system is acknowledged to be the best. It is well worth while to fit machines with them permanently or to have portable outfits that can be taken to the machines needing them for long or short runs.

Such an outfit is shown herewith in connection with a sensitive drilling job. A false table was necessary for this particular job anyway, and it was made with a rim and a boss to receive the return pipe so that there was no additional cost in making the table with this end in view.

Several cast-iron tanks, 12x18 in. on top, were available; made up with pumps and piping. These tanks were shifted to any machines needing coolants. Some of the machines, milling machines in particular, had been fitted with permanent distributing pipes, and for them it was required only to place the tank on the floor, put on a belt and connect pieces of hose between the machine and tank pipes. Other jobs, like this drill press, were fixed up by a small amount of individual work—pipes and fittings taken from stock and a distributing nozzle or pipe adapted to the work at hand.

Drilling Deep Holes in Hard Material—Discussion

By H. L. Wheeler

I was interested in the article under the title given above by A. Silvester, published on page 940, Vol. 60, of the *American Machinist*, describing his method of drilling the primer-flame holes in obturator spindles, the difficulties he encountered and the way in which he overcome them. I think he went to unnecessary trouble, and the method he used appears to be quite the reverse of the best way to do the job. From his sketch, I assume that he drilled the holes after all the turning had been done.

I have seen many hundreds of obturator spindles drilled, in all sizes from 3 to 16 in., and have drilled a few of them myself. In the large government shop where I served my apprenticeship, this job was sometimes assigned to third-year apprentices. It is the first operation upon the forging, and should be carried out in the following manner:

A spot is turned near the end of the spindle for a steadyrest bearing and the piece is chucked in an ordinary lathe with the mushroom head in the chuck. Special long twist drills are held in a drill chuck in the tailspindle of the lathe and the piece is rotated at high speed. Pure lard oil is used as a lubricant, and the drills are withdrawn after each two inches or so of drilling in order to clear the hole from chips. Short drills are used at the start and exchanged for longer and still longer ones as the hole increases in depth.

I have seldom seen greater difficulty encountered in drilling these pieces than the breaking of a drill, and this was usually due to carelessness or, perhaps, to a hard spot in the forging. A forging was seldom scrapped because of a broken drill, as the latter could generally be removed by hammering the forging while it was held in a vertical position, or, in the most extreme cases, by drilling from the opposite end and pushing out the broken drill.

After the primer-flame hole is drilled, the ends of the hole are reamed for centers and the piece finish-turned upon these centers making it true and concentric with the hole. There was always plenty of stock allowance on the forging, so that if the drill should run a trifle "out" the piece would clean up without difficulty. The final—and the most particular—operation was the boring and reaming of the taper seat in the end of the spindle for the primer.

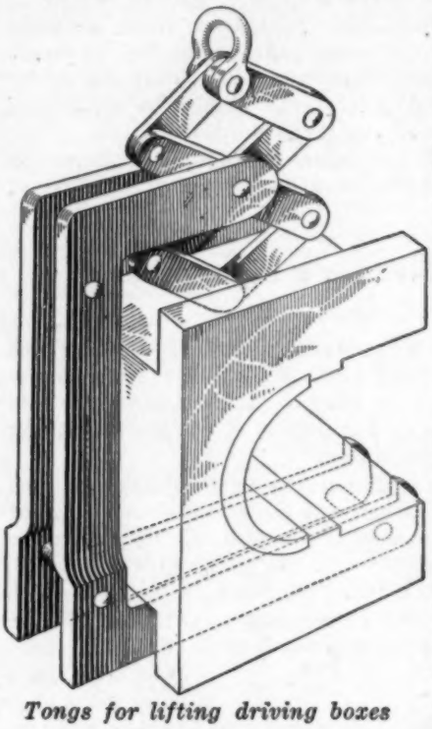
The above described method is followed in army ordnance shops, the naval gun factory in Washington, and in the shops of several foreign governments as well as in private gun shops. The operation has been performed in the same way for the past thirty years or so, and I think if Mr. Silvester would follow the plan here outlined he would have no trouble. The time on the job runs from one to three hours, according to the size of the spindle to be drilled.

Driving-Box Lifter

BY F. M. A'HEARN

Fitting driving boxes to the axles was a simple matter a few years ago, as the boxes could readily be lifted by hand and "spotted" on the axles. When locomotives became larger and the boxes heavier, a plank, a few blocks and a roller comprised adequate facilities for driving-box fitting. But with the heavy locomotives of today, the boxes are of such weight as to preclude their being handled by "strongarm" methods.

Tongs somewhat of the shape of those used for handling ice, and provided with means for attaching them to a crane hook, will take care of boxes having sufficient clearance between the grease-cellar fit and the axle diameter, but as the larger boxes do not usually have sufficient clearance at this point, other devices must be provided for handling them.



Tongs for lifting driving boxes

The device illustrated may be slipped under a box as it lies upon its flanges and, when the clevis is drawn upward the lower part of the "lazy tongs" is forced downward against that part of the box between the flanges, gripping the box in the manner of a C-clamp. The frame is made of two pieces of ⅜x3-in. open-hearth steel, spaced as far apart as will go between the flanges of the smallest boxes to be handled. The toggle links are ½x2 in., the short ones 6 in., and the long ones 12 in., in length.

The arrangement, in connection with the crane, forms a quick, safe, and cenvenient means for lifting boxes from the floor to the axles.

A Self-Expanding Piston Pin

BY CLIFFORD H. FRENCH

The use of aluminum or other light alloy pistons has brought with it the problem of a more rapid expansion than occurs in the cylinder, the piston pin or connecting rod. Piston pins fitted into aluminum pistons at normal shop-temperature, loosen appreciably when the motor is hot and are very tight on a cold winter morning.

In order to equalize the expansion, the Franklin Co. has devised the method of making piston pins shown herewith. The pin itself is hollow and has a narrow slit the whole length. Inside is an aluminum plug which is a snug push fit so that the steel shell will hug the aluminum center at the lowest temperature. The shell must also be capable of expanding to maximum motor temperature without fracture. In order to meet these requirements, as well as that of wear, the steel used in the pin must be both hard and tough, and yet not brittle in any way. On this account an alloy steel is used which will give the desired qualities by oil tempering and drawing, the usual carbonizing method not being suitable for a shell of such thin material.

A self-expanding piston pin

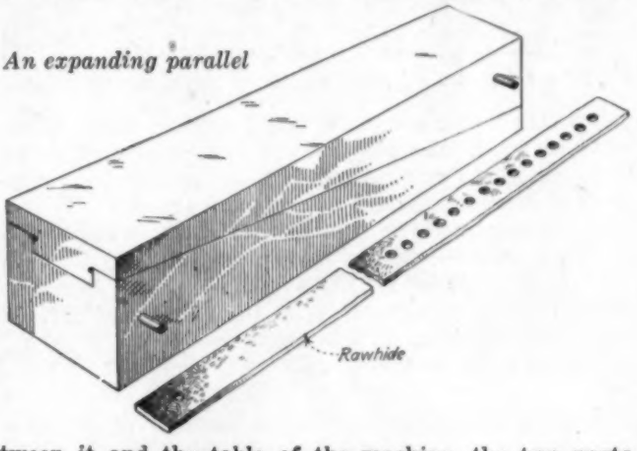
Shells of various thickness have been tried, ⅛ in. or thereabouts, seeming to be very satisfactory. With these shells there is very little difference in the fit of the pin in the aluminum piston at any temperature between zero and 200 or 212 deg. F. It is our understanding that while this pin has been patented, the Franklin Co., is perfectly willing to allow others to use it.

Wedge Parallels for Shaper Jobs

BY F. J. WILHELM

A handy tool for use around the shaper, planer or milling machine is the wedge parallel shown in the accompanying sketch. Such parallels are very useful for supporting the weight of large work that must be planed or milled on centers; as, after the work has been positioned by the index the parallel can be placed between it and the table of the machine, the two parts pushed together lengthwise until the space is just filled, and the weight of the work as well as the additional thrust of the cut is thus solidly supported and the center points relieved of undue strain.

An expanding parallel



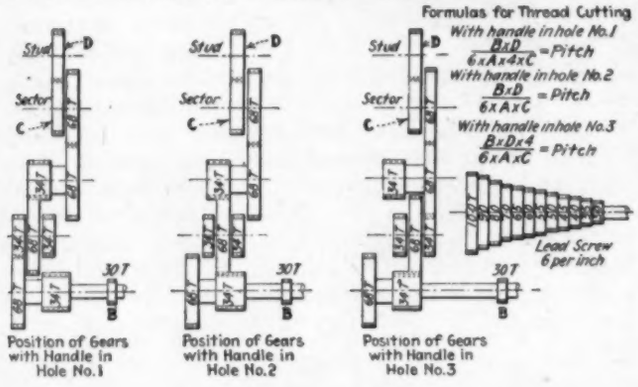
The parts should be made of mild steel, casehardened and ground all over. Especial care should be taken in fitting the tongue and groove to have the parts slide easily together, yet have a good bearing and be without any looseness. The outer surfaces should be ground with the parts assembled.

To prevent the parts from becoming loosened by vibration after having been set to fill the space between work and table, a pin should be inserted in each as shown in the sketch and a narrow strip of rawhide with holes punched in it at close intervals slipped over the pins, thus maintaining a constant tension tending to expand the parallel as far as the limitations of the table and work will allow.

Calculating Change Gears with the Aid of a Slide Rule

By Harold Herring
Stockport, England

We often have occasion to cut worms to mesh with wormwheels of 5, 10, 14 or 16 diametral pitch, etc., and the job is put up to a 16-in. Hendey lathe. In order to do the work with a fair degree of accuracy


Formulas for Thread Cutting
With handle in hole No.1
B×D / 6×A×4×C = Pitch
With handle in hole No.2
B×D / 6×A×C = Pitch
With handle in hole No.3
B×D×4 / 6×A×C = Pitch
Stud
Sector
C
D
B
307
Lead Screw 6 per inch
Position of Gears with Handle in Hole No.1
Position of Gears with Handle in Hole No.2
Position of Gears with Handle in Hole No.3

INDEX

STUD	SECTOR	HOLE	THREADS PER INCH											
48	48	1	80	72	64	56	52	48	44	40	36	32	28	24
48	48	2	20	18	16	14	13	12	11	10	9	8	7	6
48	48	3	5	4½	4	3½	3¼	3	2¾	2½	2¼	2	1¾	1½

CHANGES AT "C" & "D" FOR 16" HENDEY ENGINE LATHE

DIAMETRAL PITCH	LINEAR PITCH	CHANGE AT C	CHANGE AT D	HOLE	POSITION OF TUMBLER GEAR	ACTUAL LEAD CUT	DIAMETRAL PITCH	LINEAR PITCH	CHANGE AT C	CHANGE AT D	HOLE	POSITION OF TUMBLER GEAR	ACTUAL LEAD CUT
5	0.6283	52	49	3	1st from R	0.6282	11	0.2856	48	48	3	4th from L	0.2857
6	0.5236	60	55	3	2nd from R	0.5238	12	0.2618	45	53	3	2nd from L	0.2617
7	0.4488	49	55	3	5th from R	0.4489	14	0.2244	49	55	3	1st from L	0.2244
8	0.3927	56	55	3	5th from R	0.3927	16	0.1963	56	55	3	1st from L	0.1964
9	0.3491	50	48	3	6th from R	0.34909	18	0.1745	45	55	2	2nd from R	0.1746
10	0.3142	47	48	3	5th from L	0.3142	20	0.1571	53	50	2	1st from R	0.1572

Fig. 1—Diagram of feed gears of 16-in. Hendey lathe

I have had change gears made having from 44 to 72 teeth (with the exception of a few numbers that we were unable to cut) to supplement the regular equipment of one 46-tooth and two 48-tooth gears.

For example, let us assume that a worm is desired, having a linear pitch (or, more properly, lead) to mesh with a wormwheel of 10 diametral pitch. We first make a rough calculation as to the number of threads per inch, which we find to be as follows:

$3.142 \div 10 = 0.3142$, and

$1 \div 0.3142 = 3.2$, approximately

Assume the position of the tumbler gearing *A* and *B* in Fig. 1 to be that of the nearest number of threads per inch as shown by the index, with the compounding lever in the hole indicated. In this case the nearest number appearing on the index is 3¼, which brings the tumbler in the fifth position from the left of the bank and places the compounding lever in the No.-3 hole.

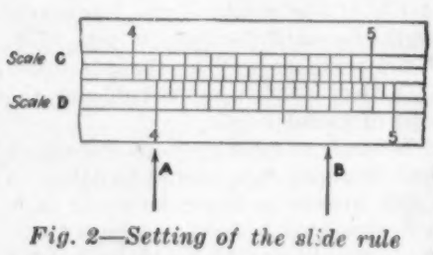


Fig. 2—Setting of the slide rule

Referring to Fig. 1, the formula for the No.-3 hole is $\frac{B \times D \times 4}{6 \times A \times C}$ = pitch, and substituting the values $B = 30$ and A (the fifth gear from the left of the bank) $= 65$, we have $\frac{30 \times 4}{6 \times 65 \times 0.3142} = \frac{4}{4.0846}$ as the ratio of the gears *C* and *D*.

If the two lower scales of a slide rule are set to this ratio, the change gears that may be used will be indicated by the coincidence of lines on the scales. Referring to Fig. 2 it will be seen that the coinciding lines are 47 on the *D* scale and 48 on the *C* scale, indicating that these gears may be used in the corresponding positions.

In order to prove the accuracy of the pitch that will be cut by the use of these gears in the positions designated we have only to place the numbers in the formula and calculate the result as follows:

$$\frac{B \times D \times 4}{6 \times A \times C} = \frac{30 \times 48 \times 4}{6 \times 65 \times 47} = \frac{192}{611} = 0.3142+$$

It may sometimes happen that no lines coincide within the range of change gears available, in which case try the tumbler gears in the next position, either to right or left. A good result should be obtainable from one or other of the three positions.

I have compiled the table in Fig. 1 to show the changes to be made at *C* and *D* to cover a wide range of diametral pitches.

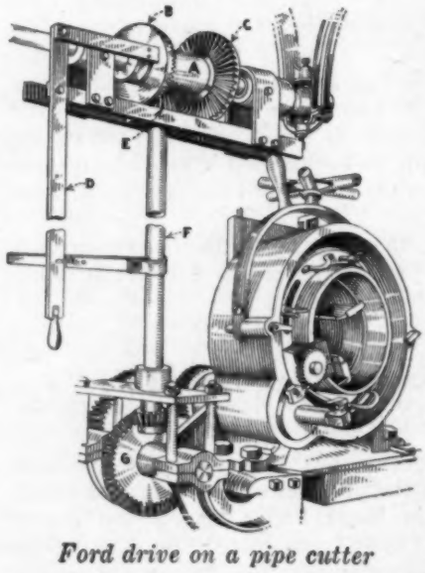
Gear Drive for a Pipe Cutter

By Charles F. Henry

I saw one of the best possible tributes to the strength and toughness of Ford driving gears the other day in the shop of the Hazen Machine Co. at Sarasota, Fla. The drive is shown in Figs. 1 and 2, the machine being an 8-in. Curtis pipe cutter.

Belts had given considerable trouble from various causes, so the moving spirit of the establishment devised and built the drive shown. A quill *A*, Fig. 1, on the line shaft carries the two Ford ring gears, *B* and *C*. Motion is controlled by the lever *D* which shifts the quill and holds it with either gear engaging the pinion *E*.

The pinion is on the upper end of a drive-shaft tube *F*, which carries a similar pinion at its lower end, the lower pinion being in permanent mesh with the lower ring gear *G*, Fig. 2. Used in this way the gears make a positive drive, but the reversal, by throwing gear *B*, and *C*, in or out of mesh, puts the gears to a very severe test. For, while the forward driving gears engage before the die begins to cut the thread, the reverse gear goes into mesh when the pipe is in the die, and starts to back it off—no easy job.



Ford drive on a pipe cutter

It is something of a problem as to how this drive would stand up if it were constantly in use. But used intermittently, as in this case, it has given excellent satisfaction. And it is certain that no gears or pinions which were not of high-grade material, could stand any such treatment. Two years' use, however, seem to have had no bad effect on the gears.

Technical Abstracts

The Traffic Signal

Herbert Maynard, Jr., President of the Traffic Signal Corp., New York City, has stated that the growing intensity of this demand for protection to the users of highways has resulted in the development of a new industry, the manufacture of highway traffic signals and there seem to be great possibilities in this new industry. To visualize this, it is stated that one railroad in this country is now operating over a quarter million signals and that the network of highways all over this country exceeds by several hundred per cent the mileage of any railroad, so it is possible that with the increased use of traffic signals this may develop into a really large industry. One authority states there is a demand for at least 500,000 signals on United States highways.

A traffic signal on the highway is designed for life-saving duty. It is charged with the responsibility of remaining illuminated all night and every night. Failure in this duty is a serious offense as such a signal without lights after dark at once becomes a menace on the highway and far from preventing accidents, is likely to be the direct cause of a very serious accident. Manifestly, therefore, only the most dependable and unfailing means of illumination must be employed.

At the present time a very definite movement is under way to bring about a standardization of traffic signals in order that the traveling motorist may immediately recognize such a signal wherever he sees one and thus appreciate its significance when approaching rather than upon arriving at it.—*National Electric Light Ass'n Bulletin*, July, 1924, p. 448.

Capital Requirements for Manufacturing

W. E. Layman, President of the Wagner Electric Corp., St. Louis, Mo., divides manufacturing companies into three groups:

1. The very large companies with sales exceeding $25,000,000 annually which he designates as group "A."
2. The intermediate companies who will average within $10,000,000 a year, designated as group "B."
3. The so-called "one-man" companies doing business of less than $500,000 a year, designated as group "C."

He tabulates the capital requirements of thirteen companies, three in group "A," five in group "B" and five in group "C." Taking the balance sheets for the years 1922-23 and studying these he shows that the capital requirements irrespective of the size of the business are very large, much larger in fact than are generally supposed. The capital requirements also grow very rapidly with the size of the business. The annual turn-over of capital is at a very low rate and a "one-man" business requires 72c. of capital for each $1 of sales even when occupying leased plant facilities. The investment in inventories is very large, approximating in all companies about one-third of the total invested capital. The plant investment grows very rapidly with the growth in size of the business.

From this consideration of capital requirements he proceeds to make some general observations on the business:

1. There is a constant temptation for engineers to organize small electrical manufacturing companies, usually undertaken without a fair comprehension of the capital requirements of the industry.
2. The so-called "one-man" business is usually started without crystallized conception of those few policies which are really essential to the commercial prosperity in industry.
3. There is a great tendency throughout to indulge in mass competition and confine production to strictly standard products which many well developed companies are manufacturing. This is particularly true of the small companies which would be better engaged in specialty production.
4. There are numerous companies operating without adequate cost-keeping systems and sales policies are often based on erroneous ideas as to the costs.
5. It is a besetting sin of this industry to endeavor to cover up unsound operations by constant endeavors to increase the volume of sales for the purpose of reviving declining profits.—*Iron Age*, July 24, p. 210.

Analysis of Modern Industrial Management

People invest their money in business for the sake of profits which they believe the business will earn, but excessive profits earned at the expense of capital, or labor or even the public have not generally proved to be continuous. For this reason enlightened management has gradually grown to be considered more of an asset than plants, goods or working capital.

Dwight T. Farnham discusses the term management, which is now generally used by business men, bankers and the investing public to indicate the forces which are responsible for the safety of invested capital and the continuity of satisfactory earnings from such investment. Safety and earning power depend upon the wise purchase of raw materials, upon efficient production—which means a low labor turnover and the elimination of waste of labor and material—upon an effective sales force and upon conservative financial management.

Management has two principal functions. One is concerned with the formulation of policy and the other with carrying out the policy decided upon. Wise management first thinks and then acts.

The administrative function of management is concerned with the collection of facts, their arrangement and correlation, whereas executive function is concerned mainly with the personnel—with the motivation of the organization to do things. The human element is paramount for this reason. Modern management, whether sales, production or financial, is concerned quite as much with human relations as with basing decisions upon facts, if it honestly desires to serve the three parties to industry, capital, labor and the public.—*American Management Review*, July, p. 3.

Grinding Operations Expedite Manufacture of Machine Tools

At one time grinding machinery and abrasive operations were considered necessary for extreme accuracy or fine finish only. Following the development of grinding machinery and the progress made in the scientific selection of grinding wheels there has come about the realization that the use of grinding machinery could be extended profitably in numerous cases. The present tendency in the well-equipped shop is to eliminate machining to size in an engine lathe whenever practical. The parts are usually rough-turned in the lathe and then are finished by grinding.

W. E. Groene states that surface grinding is employed in the manufacture of LeBlond machine tools and such parts as thrust collars, both hardened steel and cast iron, which are ground on rotary-table surface grinders, also hardened washers, friction disks for multiple-disk clutches, dividing-head index plates, etc. The tops of lathe carriages and the tops and sides of milling-machine tables are ground on a special planer-type grinder of the company's design. This machine, which is illustrated, is an adaptation of the LeBlond planer, the tool heads being removed and being replaced by a grinding head with the necessary overhead shafts and pulleys. The wheel used is carbide of silicon, 24 in. in diameter, 4-in. face, 20 grit, and Q grade. It is operated at a surface speed of 4,000 ft. per min. while the table travel is 24 ft. per min. The depth of cut varies from 0.03 in. for roughing to 0.002 in. for finishing cuts.

Illustrations are given showing this operation and one or two others.—*Abrasive Industry*, August, 1924, p. 189.

Economy Runs on Lathes

The Siemens-Schuckert Werke has carried out comparative measurements of the power consumption of two lathes, both individually driven, but one driven by an electric motor mounted integrally on the lathe, the other by an electric motor driving through a countershaft and step cones. The integral drive of course proved much more economical, especially at low-load factors, when the countershaft would be kept running idle much of the time. In such cases integral drive was found as much as 134 per cent more efficient than the intermediary drive.—*Die Werkzeugmaschine*, June 15, 1924, p. 205.

American Machinist
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KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Getting Out the Vote

NO ONE will quarrel with the statement that it is the civic duty of every American to vote at national, state and municipal elections. Yet in spite of this generally accepted truth, balloting has decreased from 80 per cent in 1896 of the possible total entitled to vote to 50 per cent in 1920. In congressional districts the percentages nave been even less.

This year efforts are being made to "get out the vote" and if possible bring the percentages up to at least those of 1896.

Employers have a higher duty than simply to obey this urge. It is squarely up to them to see that their employees take every advantage of the franchise. Welfare departments, personnel departments and foremen's organizations should wage campaigns to see that the men in the shop register and vote for the candidates of their choice, not only in the forthcoming national election, but in all elections in the community.

Fewer spectacles of unintelligent congressmen would be evident if more intelligence were used by the voters in picking their representative. Fewer blocs would result if the majority voiced its opinions. Representation by the people can be accomplished only when the people will it. Better men will actively enter politics only when the voters show by their interest that representation of a higher type is wanted.

The Automobile Aids Business

THERE are wails from some people, among them bankers, because farmers and others are buying automobiles instead of other products. These wailers want to take the automobiles away from farmers so that they will spend more time on the farm and less on the road. They seem to forget that the automobile enables the farmer to spend less time in hauling produce to market and so gives him more time for work or for pleasure. Nor is the complaint confined to the farmer. Workmen and small business men are charged with spending too much money for automobiles and neglecting business by driving about the country.

There is doubtless some truth in these complaints. There are always individuals who go to extremes in everything. Even the banker who protests against the farmer's automobile may be spending too much time at golf, or be driving a Rolls-Royce when a much less expensive car would answer his requirements. Many of us are doubtless spending too much time and money on radio aparatus, while others lose too much time and money at poker, bridge or mah jong.

That many people use the automobile foolishly and to excess is unquestioned. But in proportion to the multitude who save time and money by using motor vehicles, the number is negligible. If it were possible to wipe out the motor vehicle tomorrow, it is difficult to imagine the calamity, or its effect on business. The unemployment that would result might alone upset any government on earth.

Unless one is fairly familiar with the automobile industry, it is not easy to appreciate its ramifications. As users of power, machine tools, steel, wood, fabrics, glass and many other products, the makers of motor cars represent tremendous volumes of business. Thousands of small shops are making parts or accessories, thousands of repair shops and garages are keeping motor vehicles in operation. And the bankers would miss the business of this group of industries more than many of them seem to realize.

Transportation is the life of business. And because a few travel to excess, either in automobile or otherwise, hardly warrants the curtailing of these arteries of trade. Bankers are not supposed to loan money to a poor risk, no matter what the cause of his being undesirable. Each case should be treated on its merits instead of lumping them all into one class and condemning the automobile, or anything else, as the cause.

The sane use of motor vehicles is a great boon to civilization. Let us not condemn them on account of their abuse by a few.

Just Suppose

JUST suppose that railroads had about a thousand different ways of putting their trains together: some made up of many small cars, others of a few, still others of many large cars, and again others of just a few; some with the engine in front, some with it at the end, and some with it in the middle. Wouldn't you think that there was something wrong with the management of these roads? Wouldn't you think that they ought to come together in some way and find out which was the best and most economical practice, and that then all of them should follow this practice —with perhaps here and there slight variations on account of special local conditions? Isn't that the normal way of doing things and aren't railroads actually doing it?

Now suppose that you go through a lot of machine shops and find the widest and wildest varieties of methods of doing the same job; one shop reaming where the other is broaching; one shop hobbing where the other is milling; one shop milling where the other is planing and a third one is shaping, and a fourth one is slotting; one using single spindle drill presses where the other uses multiple spindles. In short, suppose you go through these shops and find practically no uniformity. Wouldn't you think that something was wrong with the industry and that it was about time they did what the railroads did in regard to their practice?

Why, you say, this is a different thing. Railroads are a public utility, and machine shops are ——

Well, granted; but

Just suppose!

Conundrums for Foremen

CONUNDRUM for a foreman: Where are the wrenches belonging to the various machines in your department?

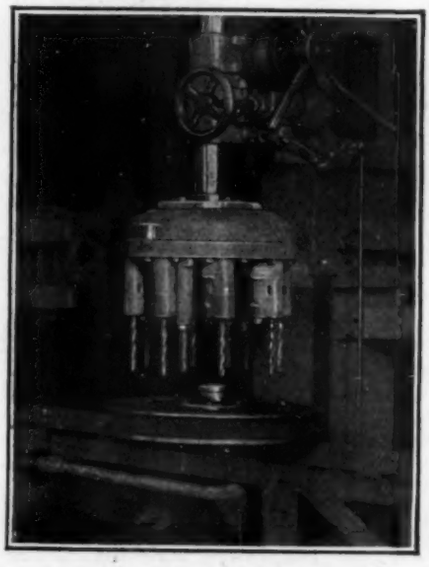
Another conundrum for a foreman: How many countershafts in your department are in prime condition?

Shop Equipment News

Buhr Multiple Drill Head

For the purpose of making the ordinary single-spindle drilling machine adaptable for work upon which a multiple-spindle drill can be used to advantage, the J. F. Buhr Machine Tool Co., Detroit, Mich., has recently placed on the market the multiple drill head shown in the accompanying illustration. This device utilizes spur gears throughout, is equipped with ball bearings, and is fully adjustable. It is designed for use on any ordinary single-spindle drilling machine.

The device has a detachable adapter and driver that transmits the power from the machine spindle through a square shaft mounted on a thrust bearing. The thrust capacity of this bearing is sufficient to



Buhr Multiple Drill Head

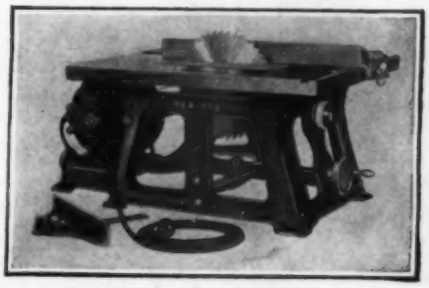
accommodate the combined thrust of all the drilling spindles in the head. The adapter has a separate drop-forged clamp which allows its length to be decreased to suit the travel of the machine head. This provides an even clamping of the adapter to the quill of the machine and tends to eliminate any strains or distortion. It is said that this design and the methods used in manufacturing the device make it possible to seat the bearings in proper alignment. An automatic lubricating system is provided and lubricates all parts of the head. The speed ratios in all types of the head are high enough to suit modern high-speed drills.

A multiple tapping head is made by using floating tap holders. These tap holders are said to relieve all excess strain on the tap while tapping or reversing, eliminating the tap breakage which is a not unusual concomitant of multiple tapping. Different sized taps may be used in this head at the same time, a tap chuck which makes this procedure possible being furnished separately or embodied in the drill spindles.

H. & A. No. 8 Portable Electric Bench Saw

A recent product of Heston & Anderson, Washington and Sixth Sts., Fairfield, Iowa, is a small, portable, electric bench saw which has sufficient capacity to cut wood 2 in. thick. The machine is fitted with a standard rip saw 8 in. in diameter and running at approximately 2,100 r.p.m. It can also be fitted with a cut-off saw or with a 6-in. dado head up to $\frac{3}{4}$ in. wide.

The spindle runs in a plain bearing that has an oil chamber at its center. The spindle mounting allows the saw to be raised and lowered in relation to the table by means of the handwheel shown at the front of the machine in the accompanying illustration. There is sufficient range



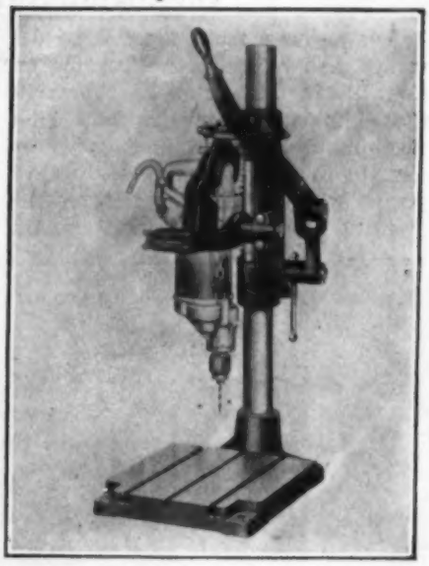
H. & A. No. 8 Portable Electric Bench Saw

in this adjustment to permit the cutting of grooves $2\frac{1}{2}$ in. deep. A $\frac{1}{3}$-hp. Emerson motor drives the machine and is mounted on a slide that is operated by the handwheel at the rear of the machine to keep the proper tension on the driving belt.

The table and its frame are of cast iron, the surface of the table being fitted with a wood throat block which can be removed when changing saws. The size of the table surface is 15 x 20 in. A ripping fence and a cut-off and miter guide are furnished. The machine weighs 110 lb. net, so it can be set on the bench and connected to any convenient light socket.

Hisey Bench Drill Stand

A bench drill stand recently placed on the market by the Hisey-Wolf Machine Co., Colerain Ave. and Marshall St., Cincinnati, Ohio, is shown



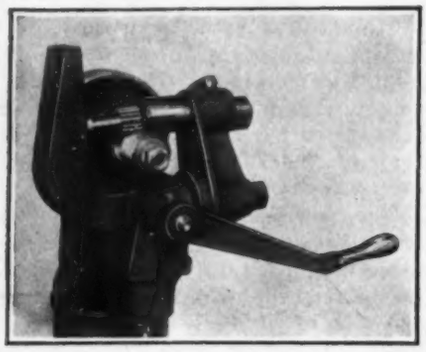
Hisey Bench Drill Stand

in the accompanying illustration. This stand is for use in connection with all types of Hisey $\frac{1}{4}$- and $\frac{5}{16}$-in. hand drills. The essential features of the device will be apparent from the illustration.

When the adapter bracket has been removed this drilling stand can also be used with Hisey portable drills of $\frac{3}{8}$-, $\frac{1}{2}$-, and $\frac{5}{8}$-in. capacity.

Dynamic Gear-Burring Machine

A machine designed to remove the burrs that are raised on the ends of gear teeth in the cutting or hobbing operation, has been developed and recently placed on the market by the Dynamic Gear-Burring Machine Co.,



Dynamic Gear-Burring Machine

14,031 Westlawn Blvd., Detroit, Mich. The operation is performed by means of a burnishing tool and a shearing tool, the burnisher being so located that it will mesh with the gear and resembling a hob in which the teeth have not been gashed. As it turns, it revolves the gear which is carried on a suitable arbor. The burnisher "irons" the burrs out so that they will project from the ends of the teeth at the desired angle and, as the gear revolves, the burrs are sheared off by the stationary cutting tool.

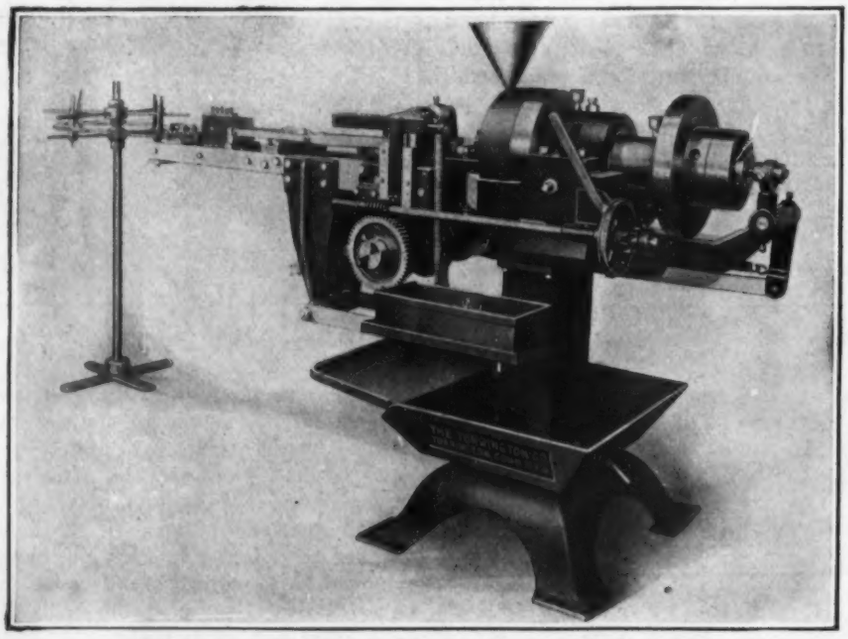
The work arbor is carried in a hinged section operated by means of the lever shown in the accompanying illustration. Raising the lever swings the arbor away from the burnisher so that the work can be changed. The action of raising the lever also disengages a clutch, causing the spindle to stop. Depressing the lever meshes the work with the burnisher, and at the same time engages the clutch, thus applying power to the burnisher spindle. The machine will handle spur, helical or bevel gears, with some exceptions, and sprockets up to 8 in. in diameter and with a 3-in. face. From 250 to 350 gears of the size shown can be burred per hr. Approximately 4 sq.ft. of floor space is required, the mechanism shown being mounted on a suitable pedestal.

Torrington Swaging Machine

A swaging machine recently designed and built by the Torrington Co., Torrington, Conn., is shown in the accompanying illustration. This machine is especially designed for use by manufacturers of optical goods, being particularly adapted for swaging spectacle bows and frames. It is said that the machine produces the reduced portions of spectacle bows at the rate of from 6 to 10 per min., approximately.

The gold-filled wire is fed from a coil through a roll straightener and the operation of swaging and cutting off the swaged pieces to length is entirely automatic. The wire used is 0.065 in. in diameter and is reduced to 0.0395 in. in a single operation. The lengths to which the parts may be finished vary from 1¾ to 3¼ in. and a means of adjustment is provided by which any length between these two extremes may be obtained. An adjustment for controlling the reduction is provided.

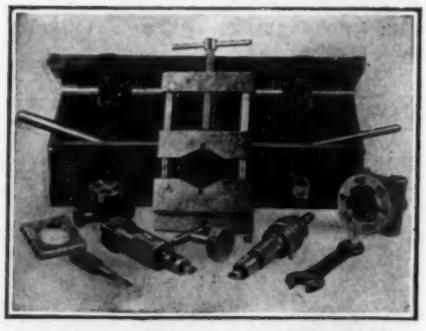
Oil may be delivered to the swaging head from a rotary pump or allowed to drip on the work from a pipe connected to a small tank on the head of the machine. The latter method is satisfactory in most cases. The weight of the machine is approximately 1,200 lb. and a 7½-hp. motor will drive eight machines.



Torrington Swaging Machine for Optical Goods

"Threadwell" Hose Coupling Standardization Tools

The Wells Corporation, Greenfield, Mass., is now marketing a complete set of tools for standardizing hose coupling threads. These tools are



"Threadwell" Hose Coupling Standardization Tools

designed for changing the many existing standards of fire hose threads to the National Standard thread recently adopted by the A.S.M.E. and approved by the National Screw Thread Commission.

Because the material of which hose couplings are made is somewhat soft, an undersized male fitting can be expanded by using the proper tool in the set, until its outside diameter is somewhat greater than the National standard. The dies provided for the purpose are then run over the expanded part and change the thread to the standard. A similar operation is performed on the coupling except when it is impossible to draw it together. In the case of small couplings a roughing tap which is tapered small enough to enter the old thread is used, the thread on the back end of the tap conforming to the standard.

News of the Week

First International Management Congress Proves Most Successful

Prague welcomes many engineers from eleven countries

By H. V. Bozell
Editor, *Electrical World*

The cordiality and gratitude with which foreign visitors, especially Americans, were welcomed at Prague for the First International Management Congress will live long in the memory of those who were fortunate enough to attend this conference. The sincerity, the earnestness—even the eagerness—which the Europeans evidenced in every paper and every discussion showed their appreciation of this opportunity to learn anything which would help them more rapidly to arrive at effective production and at the greatest earning capacity and happy existence of the individual workman. And likewise they were just as eager to contribute whatever in their experiences they had found to be beneficial. Some of the nations present were just starting or just reviving a national existence. Others were older and better organized.

There were, all told, eleven nations represented—Austria, Belgium, Czechoslovakia, France, Italy, Germany, Jugoslavia, Poland, Roumania, Russia, and the United States. Furthermore, a representative of the Secretariat of the League of Nations was present, as was also the head of the Division of Labor of the League.

The Congress Opens

The formal opening of the congress was on Sunday morning, July 20, at the Pantheon of the National Museum. The members of the congress, it will be recalled, were not only the guests, and at the behest, of the Czechoslovakian engineers and industrialists, but also of the government of the country. It was made apparent at the opening session that the government gave full recognition to industrial management and to what it means in building up the industry of the country. The government was officially represented by the heads of the various government departments.

An act which touched the hearts of Americans deeply was the memorial service which the Czechoslovakians held Sunday afternoon for Frank B. Gilbreth. The names of Hoover, Wilson and Gilbreth were the three Americans to whom all Czechoslovakia continues to give credit and it is apparent that what Mr. Gilbreth and his co-workers contributed to Czechoslovakian industry has been worth while and fully appreciated as of real value. The memorial service on Sunday, and the tributes paid to him and to his work in addresses at the service, were most impressive.

Of the regular business sessions, there were eight—morning and afternoon sessions, Monday to Thurday, inclusive. While interesting, there was not a great deal of discussion of the papers. Calvin W. Rice, in presenting the opening remarks at the first session spoke from the high spiritual viewpoint of engineering, saying that in his philosophy the engineer taught that each person has an individual responsibility and that under such philosophy the world would be set right most quickly—economically, socially, politically.

Robert Kent, in discussion of the general basis and benefits of scientific management, referred again to the four Taylor fundamentals which, he said, have been proven still to obtain:

1. Develop the true science underlying each particular class of human effort.
2. Select the worker best fitted for the particular work.
3. Continue the scientific education of the worker.
4. Effect the most cordial co-operation between management and men.

Gantt, said Professor J. W. Roe, had gone what he considered one step farther in his enunciation of the belief that two-thirds of all management improvement could be accomplished by considering these three fundamentals:

1. The most effective system of ordering materials.
2. The most effective system of transporting materials to where they were needed.
3. By seeing that all material is of uniform quality, size and treatment in all stages of its production.

Accident Discussion

In discussing H. C. Link's paper, L. W. Wallace said that American investigation shows that accidents are not so much the result of hazards but that rather they are the results of carelessness on the part of the worker and are therefor preventable by proper education. But this investigation has also shown, he pointed out, that industry is much more disorganized through the effects of illness than of accidents and that this emphasizes the attention which should be paid to the health of the worker and to his education regarding his health.

H. A. Hopf, in speaking of the experiences in profit sharing, stated it was his observation that profit sharing has, in general, fallen down as an effective move except where profit sharing has been used in connection with men who have developed, or been instrumental in developing, new processes of new fundamentals, e.g. engineers, chemists, etc. A representative of Czechoslovakian industry also made a most effective address along the same lines. He stated as the result of experience in Czechoslovakia that bonus systems and profit sharing were not what men wanted—but rather better working and living conditions and the opportunity to make more from their individual efforts.

Entertainment

The management of the congress placed at the disposal of its guests an entire fleet of automobiles with "PIMCO" on the windshields and this was open sesame to all parts of the city, with traffic halting to let the cars pass. On Monday evening, there as a demonstration of the world famed "Sokol" gymnastic system, by which practically all Czech men and large numbers of Czech women are kept in constant perfect physical trim. There were two official banquests—one by the Commissioner of Public Works and the Commissioner of Commerce, and the other by the Commissioner of Agriculture. At both of these there was further evidence of the significance of the congress to the younger nations, particularly, who were trying to arrive at maximum efficiency as early as possible. There was also an official reception in the name of the President at the presidential palace with its long history and exceptionally beautiful architecture.

Following the closing of the congress business sessions, on Thursday, the delegates were taken on several inspection trips to see Czechoslovakian industries at work. Not only were those in and near Prague visited, but also some of the larger and more important works in other parts of the country.

The American delegation included: L. W. Wallace, secretary American Engineering Council; Mrs. Frank Gilbreth, consulting expert in scientific management; Calvin W. Rice, secretary A.S.M.E.; John R. Freeman, consulting engineer; Maurice Holland, National Research Council; W. S. Murray, consulting engineer; Robert Sibley, executive manager of the University of California Alumni Association; Roy V. Wright, managing editor, *Railway Age;* H. L. Groves, commercial attache, Prague; Morris L. Cooke, efficiency engineer; Louis Marburg; Robert T. Kent, Holt Manuacturing Co.; H. A. Hopf, J. W. Roe, Prof. of Mechanical Engineering, New York University, and many others.

Notes of Washington Activities

By Paul Wooton

Regardless of public apathy toward preparedness and regardless of the hostility of the impractical to reasonable safeguards looking to the national defense, great progress has been made in that direction by the growth of the automobile and steel industries and by the voluntary co-operation of industry with the War Department. These facts are pointed out by Brig. Gen. Colden L'H. Ruggles, as assistant chief of the Ordnance Department of the Army.

The processing of steel and our great capacity for production constitute a major factor in preparedness, Gen. Ruggles states. Of equal importance is the automobile industry whose peace-time products of trucks, trailers and passenger cars are directly adaptable to military use and whose plants can be turned readily to the production of engines for aircraft, tanks and other military equipment, to say nothing of the great asset represented by the army of machinists which it has trained.

THE MANUFACTURERS' PART

Through the willingness of the manufacturers of the country to co-operate, plans practically have been perfected whereby the producers of most of the essential supplies of war now know exactly the orders they will receive and the production that they will be called upon to furnish when the War Department gives the word. They know now the exact source from which they will draw their raw materials and the exact destination to which their production is to begin to move. In many cases all of the designs and instructions are locked in the safes of the individual manufacturer.

The point has been reached, Gen. Ruggles reveals, where the Ordnance Department has embodied in proposed types of division, corps, army and railroad artillery the lessons learned from war experience. There is, of course, no hope of producing this greatly improved artillery in quantity. The limitation which Congress has placed on appropriations makes it difficult to produce adequate numbers of the new pieces for trial. Despite increased costs and increased salary scales, the Ordnance Department is given less money for its work than was the case before the war. Not only that, it receives a smaller percentage of the total of the War Department appropriations than was the case before the war. In the face of all this, however, Gen. Ruggles believes that the Ordnance Department has embodied in its new artillery more of the improvements suggested by the war than has any other government. He regrets, however, the limitations which have been placed on the Department by the failure to realize thoroughly that the real opportunity to economize in Government expenditures is to be in a position to overwhelm the enemy quickly. Millions are saved for each day clipped from the duration of war.

Since the Army shoulder rifle is such a satisfactory weapon, principal attention has been focused since the war on artillery. Small arms have not been neglected, however, and extensive experiments have been carried forward. A semi-automatic shoulder rifle which loads itself and will fire as rapidly as the trigger is pulled, has been developed. While such an arm has great potentialities, it is recognized that it will be a long time before the simpler rifle, such as is now standard, will be displaced for general use.

C. P. White, formerly in charge of distribution for the United States Fuel Administrator, has been selected to head the coal division of the Department of Commerce. This important post has been vacant since the resignation of F. R. Wadleigh.

This place was offered to Mr. White at the time of Mr. Wadleigh's resignation but he was not in a position to accept it at that time. Secretary Hoover has felt that there has been no need for haste in filling the place until a properly qualified man could be found. He also was influenced by the fact that the coal division was in capable hands under the direction of F. M. Shore, who was Mr. Wadleigh's assistant and who has served as acting chief since Mr. Wadleigh's resignation.

Mr. White also served as an assistant to Mr. Wadleigh during the time that he was Federal Fuel Distributor. At that time Mr. White was in charge at the head of the Lakes.

Railroad Equipment Exports Decline

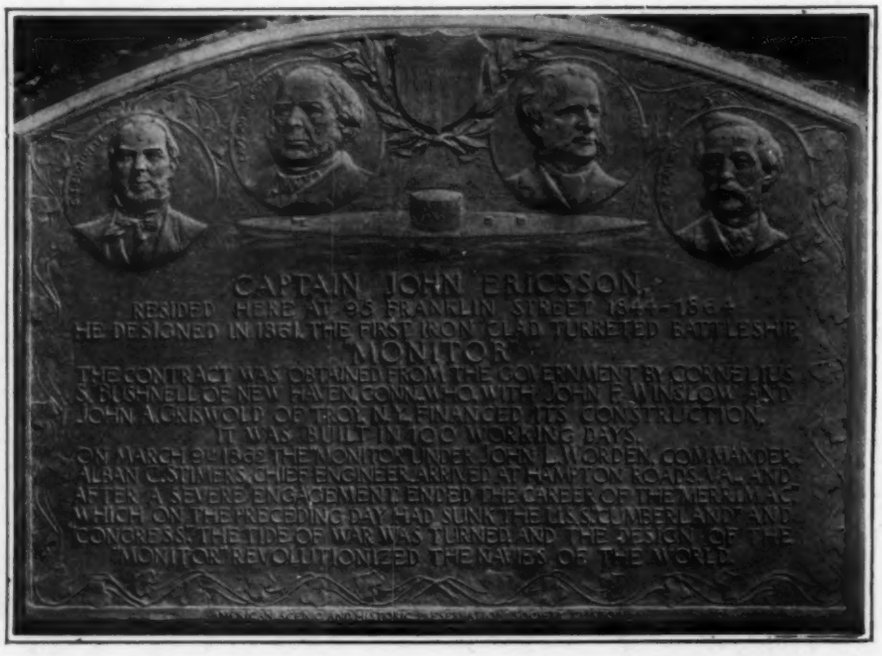
The rehabilitation and aggressive re-entry of Western European rail equipment manufacturers into world markets is the principal cause for the $10,000,000 slump in values of American shipments of rolling stock, locomotives, air brake equipment and parts for the year ending June 30, 1924, in the opinion of the Transportation Division of the Department of Commerce. The prospects during the current fiscal year are much brighter, however, with every promise for recovery. New railroads are being constructed in Latin America, while old lines are adding to their equipment.

For the fiscal year ended June 30, 1924, 279 locomotives, valued at $4,188,236, were exported as compared with 276, valued at $5,307,075 in 1923. The earthquake in Japan was undoubtedly responsible for the largest single increase in locomotive exports, for 10 locomotives, valued at $83,672 in 1923, advanced to 33 locomotives, valued at $220,846 in 1924. The generally improved condition on Mexican Railways, particularly those of the National Railway System, was responsible for an increase of from 10 locomotives, valued at $120,728 in 1923, to 21 locomotives, valued at $154,416 in 1924. The outstanding sale of 1923, 28 locomotives, valued at $703,725, to the Polish Government was not of course expected to be repeated in 1924.

The export of freight cars during the past fiscal year showed a decline of 6,760 cars with a value of $8,298,085 from the corresponding figures of 1922-1923, which disclosed shipments of 10,453 cars, valed at $11,729,962, as compared with 3,693 cars worth $3,431,877 in 1923-1924. Chile and Cuba are the only countries to show an increase in purchases from us, advances being 307 cars worth $409,590 and 67 cars valued at $147,711.

The Ericsson Tablet

The Tablet Placed Upon the Former Residence in New York City of Capt. John Ericsson


CAPTAIN JOHN ERICSSON
RESIDED HERE AT 95 FRANKLIN STREET 1844-1856
HE DESIGNED IN 1861 THE FIRST IRON CLAD TURRETED BATTLESHIP
MONITOR
THE CONTRACT WAS OBTAINED FROM THE GOVERNMENT BY CORNELIUS S. BUSHNELL OF NEW HAVEN CONN. WHO WITH JOHN F. WINSLOW AND JOHN A. GRISWOLD OF TROY N.Y. FINANCED ITS CONSTRUCTION
IT WAS BUILT IN 100 WORKING DAYS
ON MARCH 9TH 1862 THE MONITOR UNDER JOHN L. WORDEN COMMANDER ALBAN C. STIMERS CHIEF ENGINEER ARRIVED AT HAMPTON ROADS VA. AND AFTER A SEVEN HOURS ENGAGEMENT ENDED THE CAREER OF THE MERRIMAC WHICH ON THE PRECEDING DAY HAD SUNK THE U.S.S. CUMBERLAND AND CONGRESS. THE TIDE OF WAR WAS TURNED AND THE DESIGN OF THE MONITOR REVOLUTIONIZED THE NAVIES OF THE WORLD

England's Struggle to Regain Pre-War Industrial Conditions

The ravages of war are still evident economically

By E. J. Mehren
Vice-President, the McGraw-Hill Co., Inc.

The war is past history in America, but current history in Great Britain.

So, indeed, it seems after spending a week in Britain's capital, conversing with her men of affairs and listening to addresses by her business leaders and statesmen. True, there are war scars in the United States, scars that will never be erased. We are mindful of the men who died in the great struggle; we have great numbers of disabled veterans. On the financial side we still have, and will have for many years, a war-swollen budget and correspondingly increased income taxes. But, by and large, the war shadow has thinned out. Our war-time income tax rates have been twice reduced. Certainly the way is not blocked by serious obstacles. The difficulties we foresee are merely the fluctuations which, "except for the panic years," one might say are normal to business.

Not so with Britain. The war is only a yesterday with her, and the consequences are still sharp upon her. I do not mean that she is discouraged; that word has no place in the British vocabulary, nor has the state of mind it indicates any place in British consciousness. But the burdens that weigh her, the obstacles still to be overcome, are fully appreciated and are a stock subject of discussion with all her thinking men.

British Problems

To enumerate some of the troubling factors:

1. There is still large unemployment —though the amount is lessening.

2. There is marked depression in the "engineering trades," as they are called here—shipbuilding, machine tool building, and the metal-fabricating industries generally. In construction there are few large projects in hand, though there are a few that, after long delay, now seem likely to be taken in hand.

3. A new housing bill, that will again dip heavily into the national and into local government treasuries—and increases, accordingly, national and local tax burdens—is before Parliament.

4. The income tax rate on even small incomes is 4 shillings 6 pence per pound sterling, or 22½ per cent. The super-taxes are very heavy.

5. The Continental problem is acute and the consequent uncertainty, the upset exchanges, the diminished purchasing power curtail British export markets.

6. Finally, the never-ending exchange of views, with their Continental war Allies, on German reparations, keeps before the British people constantly the fact that peace, though declared five years ago, is not yet here. There is cessation of military activity; there is not that accord which is peace in actuality.

That the consciousness of the international element in these difficulties is ever present with the thinking Britisher was strikingly demonstrated at the great advertising convention held in London, at the British Empire Exhibition, last week. There were delegates from every country, though the United States sent the largest representation, 1,700 (including the ladies). To this great convention, man after man emphasized the distressed position of Europe and expressed the hope that out of the international discussions now under way in London, and participated in by the United States, there may come that peaceful adjustment for which Europe has been longing since that wonderful Nov. 11, 1918. Winston Churchill, Sir Robert Horne, J. H. Thomas, Colonial Secretary, and Lord Burnham, in particular, made this an important feature of their addresses. Every other speaker from the British Isles made some reference to the unfortunate international situation, and its effect on British industry, on British trade, and on British social and political conditions.

Politics and the Worker

In private conversation one gets an even more serious picture of England's difficulties, for there the talk turns to social conditions. Briefly, the burden of these conversations can be reduced to just this: that the altruistic promises of war times and the coddling of politicians have taken from the mass of British workers a sense of responsibility for their own welfare and led them to expect the government to take care of them.

The worst of the difficulty is that no one with whom I have spoken about this attitude of the people seems to have any hope for early improvement. The politician—not the statesman—is the ruler of the day.

Withal, though, it should be repeated, that the Englishman is not discouraged. He has lived through a lot. He hopes that he will live through this trying period and that a better day will come.

His way is not our way. We would think that his more or less complacent attitude might be fatal. He believes that the situation will turn out all right; we would fear that it would turn out all wrong unless vigorously handled.

We, I hope, would turn, so long as possible, to private measures of relief. The British have turned to the Government. The difficulties, of course, were very great; the amount of unemployment, for example, quite large. Possibly with similar conditions we would have been forced to a similar solution, but I am inclined to believe that the British tap the national treasury with less hesitation than we. The actual war, let us recall in possible explanation, lasted twice as long for them as for us.

But though our methods might differ from those of the British we cannot withhold our admiration of their sterling qualities. Similar conditions would put us in a panicky condition. They go on hanging out their sign "business as usual," confident that eventually all will be well.

Will Conduct Series of Gear Tests

A contract for the building of a special machine for use in the extended series of tests was just recently awarded to the Bilgram Machine Works of Philadelphia. These tests will be conducted under the general supervision of the A. S. M. E. Special Research Committee on Gears at the Massachusetts Institute of Technology.

This committee which is headed by Wilfred Lewis, designer of the machine, as chairman, and C. H. Logue as secretary, has undertaken to secure the necessary funds and to supply the test gears. Dr. S. W. Stratton, president of M. I. T., has agreed to provide the necessary observers for the tests who will work under the direction of Prof. E. F. Miller, head of the department of mechanical engineering. The contract calls for the completion of the machine within five months.

The full personnel of this Special Committee is as follows: W. Lewis, E. Buckingham, R. E. Flanders, A. M. Greene, Jr., C. H. Logue, F. E. McMullen, E. W. Miller and E. Wildhaber. The Chairman of the Sub-Committee in charge of the solicitation of funds is E. W. Miller, engineer, the Fellows Gear Shaper Co., Springfield, Vt. Through his efforts and those of the other members of the Committee, something over half the money necessary to cover the cost of the machine is now available in cash. A large part of this fund was contributed by firms which are members of the American Gear Manufacturers' Association and it should be stated that this Association itself has endeavored in every possible way to assist the Committee.

The Lewis Machine's Purpose

Several theoretical methods have been devised to calculate differentials in velocity ratios and increment loads as related to mass and speed, and the purpose of the Lewis machine is to afford a means of checking these theoretical computations. The new gear tester consists of a wide faced pinion mounted in bearings on a swing frame which carries a pair of engaging gears in telescoped shafts, the outer ends of which can be twisted and locked together by a powerful friction clutch. The movement used in twisting is measured by a weighted lever, and this measures the load on the gear teeth acting in equal and opposite directions upon the wide-faced pinion. By means of a Watt parallel motion connected to a stylus in contact with a smoked glass or photographic film, the shifting of the gears running in contact will be indicated, giving a story of the increment and decrement in the load carried on the teeth.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price

Editor, *Commerce and Finance*, New York

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THE United States is apparently in the second stage of a business revival. The excitement in the markets commonly called speculative has in a measure subsided and, although commodities and securities continue to fluctuate around the high levels reached about two weeks ago, the extravagant predictions of a further advance then made are no longer to be heard.

But the distributive trade of the country is undoubtedly improving and car loadings are commencing to show an increase that confirms the inference drawn from the bank clearings that have so long confuted the pessimists.

Confidence is, however, still tempered by caution and a disposition to wait upon the outcome of the election or some definite assurance of its result. The speech that candidate Davis made in accepting the nomination is generally approved of by conservative Democrats. Candidate Coolidge's address is equally acceptable to conservative Republicans.

Therefore there would be no misgivings in regard to the political future if La Follette was not in the field. But his candidacy and the fear that he may get enough votes to throw the election into the House of Representatives is the fly in the ointment and it will probably make men of affairs careful until there is some evidence of a "ground swell" in favor of one of the regular nominees.

Meantime the bankers are very busy getting ready for the German loan and disposing of other issues that will probably call for a total of well over $400,000,000. This sum includes the $75,000,000 Baltimore & Ohio bonds and $22,000,000 notes of the Japanese Industrial Bank that were brought out last week, as well as a Canadian loan of $170,000,000 that will probably be offered within ten days.

The average business man may not think that these huge loans mean much to him, but the very fact that they are so easily disposed of is convincing evidence of the opulence and economic stability of the country.

There is, however, an obverse side to every thing and while it is true that the ease with which hundreds of millions can now be borrowed in the United States connotes a superabundant supply of lendable funds it should not be forgotten that every foreign loan made brings us nearer the time when we will begin to export gold and so contract the basis upon which our credit structure rests.

The rise in foreign exchange, and especially sterling, shows that an eastward movement of capital has already commenced and if Great Britain should succeed in putting the pound back to "par" the efflux of specie will be hastened. Such a movement is in fact already under way for both Germany and India are buying silver here and some shipments of gold to the Orient were reported last week.

A discussion of developments so remote may seem like borrowing trouble from the very distant future, but it is wiser to be too early than too late in sensing a probable change in fundamental conditions, and, although I have been for more than a year persistent in pointing out the likelihood of gold inflation, I cannot shut my eyes to the fact that it is here without being recognized and that it will depart when the golden flood that brought it commences to recede.

But this counsel of prudence offered for the benefit of those who prefer to be farsighted, should not blind us to the likelihood of a good autumn trade in the agricultural regions where the high prices at which grain and live stock are selling will markedly increase the spending power of the people.

In the cities it may be a different story for the billion dollars that the recent rise in prices has added to the value and the cost of the farmers' crops will probably be doubled as it is passed on to the urban consumer who will be unable to buy luxuries because he must pay more for his food.

One result may be a demand for higher wages, which is not likely to be granted as the margin of profit in many industries is already at the vanishing point and the available statistics indicate that there is more or less unemployment already.

The stock market is steady to firm with the railway stocks in the lead. The Nickel Plate consolidation has stirred the speculative imagination, but present prices probably discount its consummation.

Bonds are firm and likely to remain so as long as money continues cheap. The approaching settlement of the reparations question has revived a fatuous hope that Germany will some day pay off the paper mark currency and bonds outstanding. The result has been a wild advance in some of these obligations. Fabulous profits are said to have been made by lucky speculators. But the truth of the stories current is questionable and those who ought to know insist that the advance is unwarranted.

Most authorities are inclined to agree in expecting less building activity in the cities during the winter and all building material except lumber are lower.

What's Doing in Industry

The machine tool and machinery trade is living on promises at the present writing. Very little actual business is reported in any part of the country, but everywhere inquiries have increased and the future looks good unless some unforeseen upset comes along between now and the middle of September when the promises should be fulfilled.

Among the encouraging signs this week are record car loadings and increased activity at the steel mills. Car loading for the week ending Aug. 2 proved to be the largest of the year with increases in all classifications of freight. Steel mills, particularly the U.S. Steel Corp. mills, increased production slightly and indications are for further increases each week.

Automobile production has also increased and it looks now as if the yearly production will equal that of last year.

The stock market steadied this week and the volume of sales increased in Wall Street. The bulls are still in full control and expect to be for some weeks.

The Dawes report continues to meet with European approval and by most people it is considered as good as in effect. Export business has been better this year than for some time past and with the full adoption of the Dawes plan further increases will be enjoyed.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Philadelphia

The general movement toward a more active industrial period continued to be manifest throughout the industrial centers of Philadelphia this week. The heads of many large establishments have signified their interest in new equipment to machine tool representatives, and some of them have started to take on additional men.

The steel industry particularly has given evidence of an anticipated early revival of activity, and the re-employment of men laid off at the beginning of the industrial slump has started in some places.

To the machinery manufacturers in Philadelphia and vicinity the situation appears encouraging. The larger manufacturers of tools and equipment assert their inquiries and orders are as plentiful as they had expected for this period, and at the end of the vacation season in September a more general revival is anticipated. Representatives of manufacturers and jobbers have been busy calling on industrial plants generally throughout the summer with encouraging results.

There is still a lack of extensive buying among the railroads. How soon there may be a revival in that line is uncertain.

The Pennsylvania State Department of Labor reports a general decrease in unemployment. At this time the department shows the demand exceeds the supply of machinists in shipyards, which are engaged in repairing and production of machinery other than marine. The Philadelphia Navy Yard is in need of first-class machinists and other workers on vessels tied up for repairs. The Labor Department reports that the unemployment situation should be well cleared up by early fall.

Detroit

There is a more optimistic feeling among executives in machine tool and machinery lines in the Detroit district.

July was the slowest month the automotive industry will probably see this year, according to all reports, and the first two weeks of August have shown a gain exceeding 10 per cent in automobile production. Machinery men feel confident that by Sept. 1 the conditions will be considerably bettered with the final quarter of the year approximating normal.

Sales remain more or less scattering with inquiries chiefly confined to special jobs. Replacements rather than new equipment predominate in the automobile and allied plants.

Many of the larger manufacturing establishments which curtailed production and reduced shifts are taking employees back as production figures increase. At the same time new models and numerous announcements of changes in plans follow one another at a rapid pace.

An increase in the manufacturing schedule for August of 33⅓ per cent over the July schedule was announced by W. R. Angell, vice-president of the Continental Motors Corp.

New York

Actual sales of machine tools and machinery in the New York district are still lacking, but the number of inquiries continues to increase almost daily. While this presages good business in September, provided the lists materialize into sales, dealers are disappointed with the showing that the month of August is making.

Buying on the list sent out by Mitsui & Co. for the Shibaura Engineering Co. of Japan was partially closed as reported in last week's *American Machinist*. Some of the machine tool companies receiving orders were; the Consolidated Machine Tool Corp. of America, the Cincinnati Milling Machine Co., the Ingersoll Milling Machine Co., the American Tool Works, and the Bullard Machine Tool Co.

Dealers are still hoping for an improvement in the automotive buying, and feel confident that with the advent of fall machine tools will be in demand in this section. Inquiries from both Jamestown and Syracuse have been received where parts makers have recently received good sized contracts from Detroit automobile builders.

Dealers in used tools report better business this week but state that August will be behind other months of the year in the total volume.

Exporters are still busy but here, too, there has been a let-up in demand. Except for Japanese buying business has not been good. It is reported from many quarters that sales of new and used tools can be made to Russia provided the credit terms offered are acceptable.

Buffalo

True to the prediction made a couple of weeks ago by some of the machinery dealers in the Buffalo territory, August business has shown favorable signs and several of the local offices are running even with, if not ahead of, last August. Some offices report that they are not closing much actual business, however, but even with these the inquiries they are receiving are so numerous and substantial that they are distinctly optimistic.

The Salisbury Axle Co. of Jamestown is reported by Buffalo machinery dealers to have been awarded a contract for axles for all Jewett and Paige cars, and this has put this concern actively in the market for drilling and grinding equipment, a large portion of which is being closed locally. It is estimated that the preliminary lists will exceed $50,000 and perhaps reach twice that amount.

One office reported little improvement in general lines, but mentioned one product, threading equipment, as doing very well indeed. Questioning revealed that this office has for some months specialized in this line and through educational methods, showing manufacturers where operations now done by hand could better be done by machinery, has brought in an unusual volume of business.

A local manufacturer reports plenty of long-range inquiries but few actual sales. However, this company is working its plant almost to capacity and up to date has not experienced any actual falling off in business. The present lack of orders may mean a slight reduction of activity a little later, but if enough of the lists which the concern is now figuring on materialize it will tend to take up the slack.

Pierce-Arrow, the American Radiator and the Chevrolet Motor Car Co. are those mentioned as being considerably more active than the general run of industry. The iron and steel plants are running quite low. Last May and June this industry locally reached its low mark of 33 per cent of normal. Today it registers 50 per cent and is increasing this percentage gradually. Building lines continue active and the bureau is receiving more requests for sheet metal workers and millwright machinists than it can fill.

Cleveland

While inquiries for machine tools, both heavy and light, were of sufficient frequency during the last few weeks to offer some real encouragement for new machinery business for the fall, actual business done to date in August by leading and minor tool builders in the Cleveland district has been very small.

Employment figures for July are believed to have reached the low ebb, and an upturn with the change from August into September is anticipated. In this connection floor and bench hands, foundry workers and assemblers are in slightly better demand in the last few weeks. There are, however, fewer calls for laborers, machine operators, core makers, polishers, tool makers.

Proof that the usual cloud has its usual silver lining is supplied in the form of some substantial orders for Cleveland firms in the last fortnight.

This development has the added satisfaction of appearing to open up some foreign trade, since at least one of these orders comes from Sweden, and while not large in the normal sense, is a big order for the present time. Several other automatics have been taken by a Philadelphia pipe-making firm, and some good business likewise has been booked with New England textile interests. In most instances these orders call for delivery to be made in the fall.

Starts Drive to Get Citizens to Vote

In an effort to get out as many voters as possible this year and thus bring up the total which has each year decreased in percentage, *Collier's Weekly* is sending to its readers "pledge cards" that contain the following promise:

"I pledge myself to vote at the coming election. But I can't vote if I don't register. Therefore, I pledge myself to register and to make that registration good with my vote."

On the reverse side of the card is a recent editorial printed in the magazine in which it is shown that, "in each national election since 1896 the proportion of voters has dwindled. In 1896, 80 per cent of those qualified to vote did vote; in 1900, 73 per cent; in 1908, 66 per cent; in 1912, 62 per cent; in 1920 less than 50 per cent. Four years ago, 54,421,832 Americans could have voted, but only 26,786,753 did so."

Noted Metallurgist at A. S. S. T. Convention

Prof. Kotaro Honda, one of the most brilliant metallurgists in the world, has notified the American Society for Steel Treating that he will be present at its annual Convention and International Steel Exposition to be held in Boston, Sept. 22-26 inclusive. Professor Honda has prepared a paper which will be read at the Wednesday morning session. It is also possible that an event may be arranged so that Professor Honda may meet some of the prominent metallurgists of this country in attendance at the Convention.

One of the symposia that is attracting considerable attention and is sure of having a "standing room only" attendance, is the one on Salt Baths as Heating Media. The contributors to this program are Sam Tour, A. E. Bellis and William J. Merten, all of whom have had wide experience in the use of salts and have written other papers on the subject. These gentlemen have not always been in agreement on this subject and the discussion should be most interesting.

The National Research Council will have its annual symposium on Hardness Testing on Thursday afternoon of the A.S.S.T. Convention. Papers will be presented by S. C. Spalding and S. L. Hoyt. Other contributions have been arranged and the symposium is always one of much interest and discussion.

Detroit Machine Tool Co. Consolidated With Norton Co.

The Detroit Machine Tool Co., Detroit, Mich., has been consolidated with the Norton Co., Worcester, Mass., manufacturer of grinding wheels and grinding machines. The Detroit company for many years has been manufacturing and marketing a centerless grinding machine.

No change in the business policy of the Detroit Machine Tool Co. will be made, Harold W. Holmes continuing as president and general manager. The company's products will still be made in the Detroit plant, 6545 St. Antoine Street.

The following officers of the Norton Co. have been added to the board of directors of the Detroit Machine Tool Co.: Clifford S. Anderson, vice-president; Henry Duckworth, treasurer; William LaCoste Neilson, and Aldus C. Higgins.

Personals

J. W. HOOK, president of the Geometric Tool Co., New Haven, Conn., has returned from a business trip to the Pacific Coast.

PAUL VOKAL has retired as superintendent of the small tool department of the Pratt & Whitney Co., Hartford, Conn. He will spend a year in California.

HARLEY L. SMITH has resigned as superintendent of shops of the Walworth Manufacturing Co., Kewanee, Ill., and will become general superintendent for Stanley G. Flagg & Co., Stowe, Pa.

BRINTON WELSER, assistant secretary and assistant sales manager of the Chain Belt Co., Chicago, Ill., has been elected secretary of the company.

HARRY G. SCHAEFER, former vice-president of the Nordyke & Marmon Co., Indianapolis, will assume the position of chief of the division of equipment of the state highway commission shortly.

CHESTER COTTON of the Allied Machinery Co. of America has been transferred from Spain to Japan where he will be associated with the Horne Co., Ltd. He sails on Sept. 11.

HERMAN D. YOUNG, a production engineer formerly with the Adams Axle Co. of Syracuse, has gone to the Salisbury Axle Co., Jamestown, in a consulting capacity.

THEODORE H. EICKHOFF, formerly chief engineer for the Auto Ordnance Corp. of New York, has joined the engineering force of the George T. Trundle, Jr., Engineering Co., Cleveland, Ohio.

HARRY S. ROBINSON is making a six weeks trip to the Pacific northwest in the interest of the Cincinnati Shaper Co., Cincinnati, Ohio.

J. H. HAGEMAN, general manager of the Bement plant, Philadelphia, of Niles-Bement-Pond Co., has resigned.

T. H. JOHNSON has been made advertising manager of the Ternsted Manufacturing Co., Detroit. He was formerly head of the statistical department.

HARVEY H. JOHNSON has resigned as treasurer and director of the Alexander Milburn Co., 1416 to 1428 W. Baltimore St., Baltimore, Md.

Obituaries

E. H. BROUGHALL, manager of the Edgwick works and foundries of Alfred Herbert, Ltd., Coventry, died recently, aged 53 years. He had been connected with the firm for about a quarter of a century, having entered the machine shops at the Butts works as a workman, but soon becoming foreman. In 1904 he was appointed manager of the Edgwick foundry and about three years later became manager of the whole of the firm's Edgwick works.

R. W. HIRST, manager of the engineering sales in the Boston office of the Buffalo Forge Co., died Aug. 10, following an operation for appendicitis.

CHARLES H. ENOS, JR., aged 50 years, advertising manager of the Henry G. Thompson & Sons' Co., saw manufacturers, died recently at his home in New Haven, Conn.

FRANK M. BALDWIN, president of the Baldwin Tool Works, Parkersburg, W. Va., died recently at Colorado Springs, Col.

Business Items

The Pawling & Harnischfeger Co., Milwaukee, Wis., has added to its plant the foundry formerly occupied by the Hercules Steel Casting Co.

The Bullard Machine Tool Co., Bridgeport, Conn., recently shipped six machines to the Missouri Pacific Railroad in one shipment.

The Union Drawn Steel Co., Beaver Falls, Pa., has purchased a site at Long Island City, N. Y.

The Twin-High Transmission Co., a subsidiary of the New Process Gear Corp., Syracuse, N. Y., has been formed to make gears for Ford cars. Anthony Henninger is vice-president and general manager.

Warren Webster & Co., Camden, N. J., have opened an office at 28 S. Pearl St., Albany, N. Y.

The Hartford Molded Products Co. of Hartford, Conn., has filed a preliminary certificate at the office of the state secretary. Attorney Harrison B. Freeman, 176 North Beacon St., Hartford; C. D. Tuska, president of the C. D. Tuska Co., Homestead Ave., Hartford, and Percival H. Spencer, 34 Baltimore St., Hartford, are the incorporators. The capitalization will be $100,000. Patents for a new small

parts molding process are pending and with rights granted the company will begin business.

The Schwimmer Engineering & Manufacturing Co., Indianapolis, Ind., with a capital of $100,000, has been incorporated to manufacture heating, cooking and roasting machines. The directors of the company are Henry W. Schwimmer, Irvin C. Stevenson, Edward O. Hind, Frank E. Worley, and Elmer P. Warren.

The American Road Machinery Co., Kennett Square, Pa., is building a new warehouse.

Jones-Davis, Inc., has been incorporated in Buffalo, N. Y., for the purpose of direct representation in the Buffalo territory for machinery and machine tools. Harry S. Davis and Lou S. Jones are the officers of the company.

The D. D. Co., 43 Allyn St., Hartford, Conn., was recently organized with a capitalization of $50,000. J. H. Deming is the president and treasurer; Walter DeMara is the vice-president; and Mary E. Deming is the secretary. The company will specialize in the manufacture of pistons.

The Robert Bosch Magneto Co., Inc., New York, has increased the space of its executive offices at 123 West 64th St., and has taken over the entire eleventh floor of the building.

The National Furnace & Foundry Co. that has manufactured steel furnaces in Winnipeg for some years, is now locating in Orillia, Ontario. For the time being its product is being manufactured at the Tudhope-Anderson plant.

Due to the illness of R. F. Bower, who has been inactive in business during the past year, the board of directors of the Bower Roller Bearing Co., of Detroit, at their last meeting elected the following officers: C. H. Heller, president; George W. Mearick, vice-president; Theodore C. Dye, secretary and treasurer; W. S. Bennett, assistant secretary; and E. M. Pratt, assistant treasurer.

The plant of the Southern Wheel Co., at Savannah, Ga., a subsidiary organization of the American Brake Shoe & Foundry Co., of Pittsburgh, will enlarge capacity to 315 wheels daily, and melting capacity to 250,000 pounds of iron, officials have recently announced. A new main foundry plant and a larger cupola are to be constructed.

The Kendell Co. of America, which has taken over the Motor Products Co., of Fort Wayne, Ind., is being moved to Detroit and will be in operation in the near future. The new company, which is headed by C. Anthony and Robert L. Kendell, specializes in piston rings and claims to have orders on hand for close to a million rings which call for delivery during the fiscal year. The production schedule for the year calls for 14,000 rings daily on two eight-hour shifts. The first unit of five machines, with a 5,000 ring capacity daily, is expected to be in operation in two weeks.

Construction of a large plant for the manufacture of spark plugs has been started at Miami, Fla., by the Airkool Spark Plug Co., formed recently, initial capacity to be about 10,000,000 spark plugs annually. The first unit of the plant will represent an investment of about $125,000, including equipment, and will be located on N. W. Twenty-second St., near Second Ave.

The National Manufacturing Co., Ltd., has recently been incorporated under Dominion charter in Canada. This is a consolidation of a number of long established firms, including the Cossitt Co. of Brockville, manufacturers of agricultural implements; the Canada Stove Co. of Ottawa; the National Manufacturing Co. of Ontario. Thomas Delahay is president of the company. Sales offices have been established in St. Paul, Minn., and Morristown, N. Y.

The Florida Steel & Wire Co., with a plant at Bentley's shipyard, in Jacksonville, Fla., has ordered machinery for installing a complete wire mill. The company at present manufactures nails only, establishing the plant about three months ago.

The S. Morgan Smith-Inglis Co., Ltd., has been granted federal incorporation in Canada to deal in machinery, tools, appliances, structures, engines, etc. The company is capitalized at $200,000 and headquarters will be in Toronto.

The Silex Co., 74 Union Place, Hartford, Conn., was recently organized and will engage in the manufacture of all kinds of mechanical equipment. The new firm is capitalized at $50,000. The incorporators are: F. E. Wolcott, 89 Beacon St.; C. N. Turner; J. H. Williams, all of Hartford.

Incorporation of the Phoenix Machine Manufacturing Co., Madison St., Mobile, Ala., with $250,000 capital, was recently announced. According to V. P. McCoy, president of the company, an investment of about $75,000 will be made for constructing a plant at Mobile.

Pamphlets Received

Laws Providing for Bureaus of Labor Statistics. The U. S. Department of Labor, Government Printing Office, Washington, D. C. The labor laws as set forth in the various states of the Union are contained in this pamphlet.

Proceedings of the Tenth Annual Meeting of the International Association of Industrial Accident Boards and Commissions. U. S. Department of Labor, Government Printing Office, Washington, D. C. This meeting was held at St. Paul, Minn., Sept. 24 to 26, 1923 and the stenographic report is contained in this pamphlet.

National Standard Petroleum Oil Tables. The Department of Commerce, Government Printing Office, Washington, D. C. Circular of the Bureau of Standards No. 154 contains many tests and tables regarding specific gravity and weight per gallon of oils.

Nickel and Its Alloys. The Department of Commerce, Government Printing Office, Washington, D. C. Circular of the Bureau of Standards No. 100 is an exhaustive study of nickel and its alloys with the results of many tests made by the bureau.

Trade Catalogs

Electric Grinders, Buffers and Polishers. The Cleveland Armature Works, Inc., 4732-4736 St. Clair Ave., Cleveland, Ohio. Catalog No. 315 has been issued and contains the full list of C.A.W. products including a variety of grinders, buffers and polishers. The catalog is well illustrated with halftones, sectional drawings and diagrams. Specifications for the various machines are also given.

Surface Grinding Machine. The O. S. Walker Co., Inc., Worcester, Mass. The single-stroke surface grinding machine arranged for motor drive with full explanation regarding each part is described in this catalog. In addition to the surface grinding machine are also descriptions of the Walker demagnetizer and the direct current generator. Plans for setting up the machines and specifications are also given.

Thread Miller. The O. S. Bickford & Son Co., Greenfield, Mass. This folder describes the product putting forth its many accomplishments and general specifications. An illustration helps to visualize the product.

Babbitts. United American Metals Corp., Diamond St. and Meshole Ave., Brooklyn, N. Y. Two little booklets have been mailed out by this concern which are known as "minute booklets" each containing but one idea, but so forcefully put that it cannot escape the attention of the recipient. Each tells of buying babbitts and what to expect.

Switches. The Monitor Controller Co., 500 E. Lombard St., Baltimore, Md. Bulletin No. 105 tells about the Monitor Triplock switch with the construction, principle of operation and uses emphasized.

Tool Steel. The Columbia Tool Steel Co., Chicago Heights, Ill. High-speed and high alloy tool steels with other products made by this firm are described and listed with prices in this booklet. Some very valuable hints are given on tool steels in regard to making tools and heat treating.

Forthcoming Meetings

American Railway Tool Foremen's Association. Annual convention, Sept. 3, 4 and 5. Hotel Sherman, Chicago, I.. J. A. Duca, C. R. I. & P. Railway, Shawnee, Okla.

International Railway General Foremen's Association. Annual convention, Sept. 9, 10, 11 and 12. Hotel Sherman, Chicago, Ill. William Hall, 1061 W. Wabash Ave., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fourth annual machine tool exhibit, Sept. 15-18, Mason Laboratory, New Haven, Conn. H. R. Westcott, chairman.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Motor and Accessory Manufacturers' Association. Annual meeting, Cleveland, Ohio, Week of Oct. 6.

American Foundrymen's Association. Twenty-eighth annual convention. Milwaukee, Wis. Week of Oct. 13, 1924.

National Industrial Advertisers Association. Annual meeting, Edgewater Beach Hotel, Chicago, beginning Oct. 13, 1924.

Management Week. Under the auspices of the American Society of Mechanical Engineers. Week of Oct. 20, 1924. New York City.

American Gear Manufacturers Association. Semi-annual fall meeting. Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 16, 17 and 18. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Forty-fifth annual meeting. New York City. Dec. 1 to 4. Calvin Rice, secretary, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York City, Dec. 1 to 4. Charles F. Roth, 1102 Grand Central Palace Building, New York City.

Exposition of Invention. Engineering Societies Building, 29 West 39th St., New York City, Dec. 8 to 13 inc., General offices, 47 West 34th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Quotations holding firm at $18 per ton for No. 2 fdry. iron at Birmingham. Although inquiries are plentiful, buying is mostly for immediate requirements. Steel scrap market firmer. Increasing demand for steel sheets, steel rails and railway supplies. Current mill quotations on heavy rolled products are as follows: bars, $2.10@$2.15; shapes, $1.95@$2.15; plates, $1.75@$2.10 per 100 lb., Pittsburgh.

Non-Ferrous Metals—Copper buying improving as prices rise. Tin firm; quotations higher here and abroad. Lead demand brisk. Slight upward turn in zinc during week. Fabricated brass and copper products up in New York, Cleveland and Chicago warehouses since Aug. 8.

(All prices as of Aug. 15)

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$22.05@22.55
Northern Basic	20.00
Southern Ohio No. 2	21.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.05
BIRMINGHAM	
No. 2 Foundry	18.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.77@23.27
Virginia No. 2	28.44@29.44
Basic	20.00@21.00
Grey Forge	21.00@22.00
CHICAGO	
No. 2 Foundry local	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	28.05
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	28.66

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.70@2.80	3.89	3.55	3.80
No. 12	2.80@2.90	3.94	3.60	3.95
No. 14	2.90@3.00	3.99	3.65	4.00
No. 16	3.10@3.20	4.09	3.75	4.10
Black				
Nos. 17 and 21	3.35@3.50	4.40	4.25	4.55
Nos. 22 and 24	3.40@3.55	4.45	4.30	4.55
Nos. 25 and 26	3.45@3.60	4.50	4.35	4.60
No. 28	3.50@3.65	4.60	4.45	4.50
Galvanized				
Nos. 10 and 11	3.60@3.80	4.60	....	4.60
Nos. 12 and 14	3.70@3.90	4.70	....	4.70
Nos. 17 and 21	4.00@4.20	5.00	....	5.00
Nos. 22 and 24	4.15@4.35	5.15	5.00	5.15
No. 26	4.30@4.50	5.30	5.25	5.30
No. 28	4.60@4.80	5.60	5.55	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	56%	43%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	53%	40%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	7.50	8.00	6.55
Hoop steel	4.49	3.96@4.36	4.15
Cold rolled strip steel	7.00	8.25	7.15
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.21	3.10
Soft steel bars (base)	3.24	3.11	3.00
Soft steel bar shapes (base)	3.24	3.21	3.00
Soft steel bands (base)	3.99	3.61	3.65
Tank plates (base)	3.34	3.43½	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Tool steel	11.00	....	....
Drill rod (from list)	60%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.00
Tin, 5-ton lots, New York			53.75
Lead (up to carlots), St. Louis	7.75	New York	8.37½
Zinc (up to carlots), St. Louis	6.25	New York	7.25

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	27.10	28.00	28.50
Antimony (Chinese), ton spot	10.00@10.50	10.50	10.00
Copper sheets, base	20.37½	20.25@21	23.00
Copper wire, base	18.75	18.75	21.75
Copper bars, base	19.62½	22.00	22.50
Copper tubing, base	22.75	27.25	25.75
Brass sheets, base	17.00	21.75	19.75
Brass tubing, base	21.50	28.00	28.25
Brass rods, base	14.75	17.75	17.50
Brass wire, base	17.50	21.75	20.25
Zinc sheets (casks)	10.25	10.75	....
Solder (½ and ½), (case lots)	37.50	33.50	30.00
Babbitt metal (83% tin)	60.00	62.50	48@52
Babbitt metal (35% tin)	28.00	18.50	23@26
Nickel (ingot and shot) f.o.b. refinery	27.00	....	....
Nickel (electrolytic) f.o.b. refinery	30.00	....	35.00
Nickel (F shot) f.o.b. refinery	30.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54.00
Manganese nickel hot rolled rods "D"—high manganese (base) 57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.75@11.25	10.25	9.50@10.00
Copper, heavy, and wire	10.50@11.00	10.00	11.00
Copper, light, and bottoms	9.50@10.00	8.50	8.00@8.25
Lead, heavy	6.25@6.75	5.00	5.00@5.50
Lead, tea	5.25@5.75	3.00	3.00@3.25
Brass, heavy, yellow	6.75@7.00	8.75	6.00
Brass, heavy, red	8.50@8.75	5.00	7.50
Brass, light	5.75@6.00	4.75	5.00
No. 1 yellow brass turnings	7.25@7.50	5.75	6.00
Zinc	3.75@4.00	3.75	4.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.00	12.75
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.75	6.55	6.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.20	$0.14
Cotton waste, colored, per lb.	.09@.14½	.17	.10½
Wiping cloths, 13¼x13¼, per lb	11.00*	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.	....	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	1.05	1.14	1.05
Lard cutting oil, 25% lard, per gal.	.55	.50	.79†
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.214
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber transmission:			
First grade	50%	50–10%	40–10%
Second grade	50–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	$6.48
Emery paper	10.71	11.00	8.80
Emery cloth	28.00	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag	....	.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.00@3.25
Coke, prompt foundry, Connellsville	per net ton		4.25@4.75
White lead, dry or in oil	100 lb. kegs		New York, 14.50
Red lead, dry	100 lb. kegs		New York, 14.50
Red lead, in oil	100 lb. kegs		New York, 16.00

*White, at washery.
†Chicago quotes on pure lard oil, No. 1 grade.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0334	$0.0354
Cold finished shafting	per lb.	0.0415	0.0425	0.044
Brass rods	per lb	0.1475	0.14	0.17.5
Solder (½ and ½)	per lb.	0.375	0.3375	0.295
Cotton waste	per lb.	.14@.21	.14@.21	.10@.13
Washers, cast iron (⅛ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	0.55	0.55	0.55
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	50%	50%	30%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	60–10–5%	60%
1½ and 1¼x3 in. up to 12 in.	15%	.....	....
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	40%	$3.50 net	60%
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	3.50 net	60%
Button head bolts, with hex. nuts	10%	List net	.....
Hex. head and hex. nut bolts	10%	.....	.....
Lag screws, coach screws	50%	.....	65%
Square and hex. head cap screws	75%	75%	.....
Carriage bolts, up to 1 in. x30 in.	40%	60%	55%
Bolt ends, with hot pressed nuts	50%	.....	60%
Tap bolts, hex. head, list plus	35%	.....	$4.65
Semi-finished nuts, ⅜ and smaller	70%	.....	.....
Semi-finished nuts, ½ and larger	65%	70%	.....
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.75
Washers, cast iron, ⅜ in., per 100 lb. (net)	5.50	4.00	3.75
Washers, round plate, per 100 lb. Off list	1.50	4.50	4.50
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	4.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	4.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	4.00	4.00
Rivets:			
Rivets, ⅞ in. dia. and smaller	50%	60–10%	70%
Rivets, tinned	50%	60–10%	70%
Button heads ¾-in., ⅝-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.50	$3.50
Cone heads, ditto (net)	5.20	3.60	3.70
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
¾ in. diameter *EXTRA*	0.35	.....	0.15
½ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	....

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Calif., Yuba — Yuba City Union High School District—1 metal lathe, 1 portable electric drill, one 3-in. band saw, 1 lot of science equipment.

Mass., Worcester — Worcester Pattern & Model Co., 93 Harding St.—wood turning lathe with set over tail stock.

Minn., Minneapolis—W. F. O'Neill, 126 East 26th St.—combination beading and crimping machine, 30 in. formers.

N. J., Newark—Martian Mfg. Co., 171 Washington St.—1 power press, Leh & Hahneman, No. 5.

N. Y., Brooklyn—Ernessen Electric Co., 118 Hamilton Ave.—drill press.

N. Y., New York—G. W. & E. D. Sheridan Co., 401 Broadway—16 in. back geared shaper. E. R. Seider, Purchasing Agt.

N. Y., Plattsburg—Plattsburg Foundry & Machine Co., G. Rotherwel, Purch. Agt. —1 standard pattern planer, one 60-in. 3 head planer, 1 surface grinder, 1 engine lathe, one 52 in. horizontal boring mill, one 36 in. horizontal boring mill, one 6 ft. radial drill, two 3 ft. radial drills, one 3 spindle high speed drill, 1 plain milling machine, 1 auto horizontal milling machine.

W. Va., Charleston—F. Lory & Sons—power and hydraulic press with dies.

Wis., Milwaukee—H. A. Poppert & Son, 421-3rd St.—24 in. x 12 ft. engine lathe and 2 polishing lathes.

Ont., Coldwater — Charles Galbraith — emery grinder, bench lathe, etc.

Ont., Fort William—The Northwestern Elevator Co.—grain handling equipment.

Ont., Midland—E. Brown & Sons, 209 Hugel Ave.—lathe, grinder press (need not be new).

Ont., Orillia—D. M. McClelland, 60 West Street—Vulcanizing equipment.

Ont., Penetanguishene—The C. Beck Mfg. Co., Ltd., W. F. Beck, Purch. Agt.—mechanical equipment for machine shop.

Ont., Penetanguishene — Gropp Bros., August Gropp, Purch. Agt.—shingle making machine.

Ont., Penetanguishene—Penetanguishene Carriage Co.—woodworking equipment.

Ont., Penetanguishene—Sidney Boat Co. Ltd.—lathe and other equipment. H. M. Warnock, Mgr.

Ont., Washago—R. Marshall—band saw, circular saw, etc.

Que., Bonaventure — The Escouminac Lumber Co., Ltd.—band saws, saw carriers, engine burner and saw mill supplies.

Que., St. Jerome —P. Saumur—sander, band saw, etc.

Que., Terrebonne—Desfardins & Fils—jointer and mortiser.

Opportunities for Future Business

Calif., Los Angeles — Fairbanks-Morse Co., 427 East Third St., manufacturer of scales, etc., plans to construct a factory. Estimated cost between $750,000 and $1,000,000.

Calif., Los Angeles—P. Whiting, c/o L. C. Maurer, Archt., 320 North Rampart Blvd., is having plans prepared for the construction of a 4 story, 120 x 155 ft. garage on Figueroa St. Estimated cost $150,000.

Conn., Bristol—The E. Ingraham Co., manufacturers of clocks and watches, plans the construction of a 1 story, 76 x 200 ft. and 1 story, 80 x 80 ft. addition to its factory on North Main St. Estimated cost between $60,000 and $75,000.

What This Section Is

Machinery Requirements and Industrial Construction is a reliable machinery market, because every item is reported first-hand by our own correspondents, scattered over the United States and Canada. These leads are verified by our men. We do not use newspaper clippings, nor do we listen to any hearsay or rumors. These sales leads are as accurate as our men can make them, and as timely as weekly publication will permit.

This market is for *American Machinist* subscribers. It covers the same machinery fields as does the paper. Here will be found inquiries for machine tools, presses, hammers, welding, forging and heat treating equipment, wood working machinery, cranes, hoists and other material handling machinery for the shop.

Here also will be found reports of proposed industrial construction, where sooner or later machinery will be needed.

Are you making the most of the opportunities listed here?

Conn., Greenwich — The Tyson Motor Sales Co., 116 Greenwich Ave., plans the construction of a 60 x 155 ft. garage on Boston Post Rd. The Company will be in the market for machine tools and mechanical equipment.

Ga., Atlanta — Bolling H. Jones, 913 Peach Tree St., Robert P. Jones, Atlanta Trust Co. Bldg. and Joel Hurt, Jr., Hurt Bldg., plan the construction of a 6 story garage on Ivy St. Estimated cost, $900,000.

Ill., Chicago—Clayton Mark & Co., 111 West Washington St., manufacturer of wrought pipe, has awarded the contract for the construction of a 90 x 120 ft. plant at 74th and Robey Sts. Estimated cost, $30,000.

Ky., Louisville — Hoffman Heater Co., Lorain, Ohio, plans the construction of a new factory, here. Estimated cost over $40,000.

Md., Sparrows Point—Bethlehem Steel Co. has awarded the contract for the construction of a 2 story service building and equipment for coke department. Estimated cost $50,000. Noted July 10.

Mass., Boston—The Gillette Safety Razor Co., 41 West 1st St., has awarded the contract for the construction of a 2 story, 70 x 75 ft. plant at South Boston. Estimated cost, $40,000.

Mass., Boston—(East Boston)—Sutherland & Sutherland, Archts., 79 Summer St., Boston, are preparing plans for the construction of a 1 story, 105 x 160 ft. garage. Estimated cost, $150,000. Owner's name withheld.

Mass., Fitchburg—Simonds Saw & Steel Co., 470 Main St., has awarded the contract for the construction of a 3 story 50 x 150 ft. addition to its manufacturing plant. Estimated cost, $120,000. Noted Aug. 14.

Mass., Lynn—Thomson Electric Welding Co., 161 Pleasant St., plans the construction of a 1 story addition to its factory. H. M. Haven and A. T. Hopkins, 11 Beacon St., Boston, engrs.

N. Y., Alden—Bennett Mfg. Co., manufacturers of metal novelties, has awarded the contract for the construction of a 1 story, 120 x 126 ft. garage, with 40 x 80 ft. wing, and a 16 x 20 ft. boiler house. Estimated cost $100,000.

O., Cleveland—The C. O. Bartlett & Snow Co., French and Winter Sts., manufacturer of elevating and conveying machinery, has awarded the contract for the construction of a 1 and 2 story, 218 x 333 ft. factory at 6200 Harvard Ave. Estimated cost $200,000. Noted Apr. 24.

Pa., Pittsburgh—Cullin & Buchalla, 1310 Unity St., has awarded the contract for the construction of a 2 story 20 x 20 ft. and a 1 story 20 x 57 ft., auto repair shop at 4450 Leiper St. Estimated cost $6,500.

Pa., Pittsburgh — The Williams Gauge Co., manufacturer of steam columns, has awarded the contract for the construction of a 1 story, 60 x 120 ft. machine shop and office building on Pennsylvania Ave.

R. I., Providence — The Rhode Island Malleable Iron Co., Hillsgrove, has awarded the contract for the construction of a 1 story, 122 x 140 ft. foundry. Estimated cost between $55,000 and $65,000.

Tex., Dallas—The Atlas Metal Works, 2201 Houston St., plans the construction of a factory. Estimated cost, $40,000. Work will be done by day labor.

Wis., Marinette—M. & M. Box Co., Homer St., c/o H. Greene, 559 Marshall St., Milwaukee, Pres., plans to rebuild saw mill destroyed by fire.

Ont., Salem—W. Mobray, c/o Copeland Ziegler Mills, plans to rebuild the flour and chopping mill destroyed by fire and is in the market for equipment. Estimated cost, $30,000.

Ont., Wiarton—G. E. Reckin plans to take over an old mill here and install equipment for the manufacture of chesterfields, chairs and upholstered furniture. Estimated cost, $35,000.